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SIR J. D. HOOKER

K.C.S.I., M.D., D.C.L., F.R.S.

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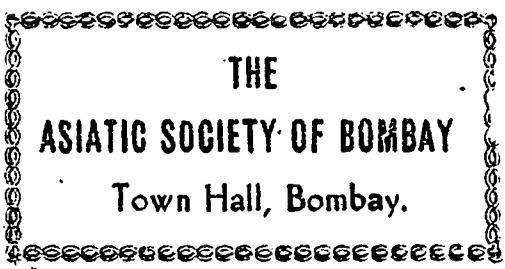

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HIMALAYAN JOURNALS;

OR,

NOTES OF A NATURALIST

IN BENGAL, THE SIKKIM AND NEPAL HIMALAYAS,
THE KHASIA MOUNTAINS, &c.

87006

SIR JOSEPH DALTON HOOKER,
K.C.S.I., C.B., M.D., D.C.L., F.R.S.

WITH MAPS AND FULL-PAGE AND OTHER ILLUSTRATIONS.

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TO

CHARLES DARWIN, F.R.S., &c.

This Volume is Dedicated,

BY HIS AFFECTIONATE FRIEND,

J. D. HOOKER.

KEW, *Jan.* 12*th*, 1854.

DHURMA RAJAH'S SEAL.

EDITOR'S INTRODUCTION.

THE "Himalayan Journals" of Sir Joseph Hooker at once took rank, on their first publication, with the most interesting and informing books of travel in existence. The book was, however, inaccessible to the general public on account of its price, but has long been one of those works that every science student would like to have on his shelves. The Editor was therefore specially gratified when Sir Joseph Hooker consented to the publication of this inexpensive edition, and Mr. Murray agreed to supply copies of the original woodcuts, many of them from original drawings by Sir Joseph. The book will speak for itself. It is reprinted from the first (unabridged) edition, with the omission of some of the appendices which were only of limited general interest.

A slight sketch of the career of the author will be welcome to many readers. Sir Joseph Dalton Hooker is the second son of the late Sir W. J. Hooker, Director of Kew Gardens, his mother having been a daughter of Mr. Dawson Turner, F.R.S., of Yarmouth. He was born in 1817, at Halesworth, Suffolk, and after the usual course of medical study, graduated M.D. in 1839, at Glasgow University, where his father was then Regius Professor of Botany. When only twenty-two he went as assistant-surgeon, and practically, though not officially, as naturalist, with the famous Antarctic Expedition of 1839–43, under Sir James Clark Ross, in H.M. ships *Erebus* and *Terror*. The botanical results of the expedition were published during subsequent years by Sir Joseph (then Dr.) Hooker in six splendid quarto volumes, which included the flora of the Auckland Islands, New Zealand, and Tasmania. In

this work the comparison of new plants with those already known in other parts of the world led to many novel conclusions as to the laws governing the distribution of plants over the earth's surface. Having turned aside to fossil botany in connection with the Geological Survey, he contributed in 1846 a valuable memoir on the vegetation of the coal measures as compared with that of the present flora.

Being eager to enlarge his knowledge of the various kinds of plants in their natural situations, Dr. Hooker was in 1847 persuaded by Dr. Falconer, then acting as botanist to the Indian Government, to visit the Himalayas, where a great variety of floras might be studied at successive altitudes. Sikkim, previously unvisited by British explorers, was the territory in which he made his advance upon the great Indian range. The story of the expedition is told in the "Himalayan Journals," first published in two volumes in 1854. While yet in India, in 1849–51, he had published his magnificent illustrations of the rhododendrons of the Sikkim Himalaya, most of which he himself introduced into England. He has since, in conjunction with the late Dr. Thomson, published the first volume of a great "Flora Indica," and his more condensed "Flora of British India" is now approaching completion. The English student is indebted to him for an excellent "Flora of the British Islands," which was prepared afresh from the best specimens and authorities. It is a singular fact that the Eastern Nepal passes into Tibet, which Dr. Hooker explored in 1849, have never since been approached by a European.

In 1855 Dr. Hooker was appointed Assistant-Director of Kew Gardens, and on his father's death in 1865, succeeded to the Directorship, which he held for twenty years. Every one knows and admires the arrangements and visible treasures of Kew Gardens, but few are aware of the priceless herbaria carefully preserved there, containing type-specimens, often unique—all being gradually described and illustrated by the corps of able botanists congregated at work there.

In 1868 Dr. Hooker was President of the British Association at its Norwich meeting. His address on that occasion attracted

very great attention, as it included a full consideration of Mr. Darwin's views on the evolution of living creatures, and an endorsement of them based on considerations of the geographical distribution of plants, and many other phenomena of plant life. Dr. Hooker also claimed for science a field of study in which theologians must be content not to pronounce, and advocated the friendly pursuit by both science and theology of objects which they have in common. This reference to evolution and Darwin, recalls the frequent mention of Dr. Hooker in the life of Darwin. He was Darwin's earliest confidant in his speculations on the "Origin of Species." All through the long incubation and maturation of Darwin's ideas, Dr. Hooker acted the part of friendly critic, suggesting difficulties for solution, and searching out botanical facts, and finally, with Sir Charles Lyell, persuading Darwin to bring out his celebrated paper in 1858, which was read to the Linnean Society on the same night as Mr. Wallace's independent memoir. He was afterwards able to give the new theory most valuable support in his "Introduction to the Tasmanian Flora." Those only who have read Darwin's life will be able to appreciate the great influence Dr. Hooker had with his friend, and the value which his botanical knowledge gave to his advice.

In the spring of 1871 Dr. Hooker undertook another expedition into a botanically unknown region, the mountains of Morocco, in company with Mr. John Ball, F.R.S., and Mr. George Maw, both accomplished botanists. On the 16th of May, 1871, the explorers ascended the Great Atlas, the summit of which had never yet been reached by a European. A large collection of plants was added to Kew by this expedition, and the "Journal of a Tour in Morocco and the Great Atlas" gave a popular account of the tour, in 1878.

In 1860 Dr. Hooker visited Syria and Palestine, where he discovered that the cedars of Mount Lebanon occupied ancient moraines; and in 1877 he made a botanical tour, in company with the late Prof. Asa Gray, across the continent of North America.

In 1873 Dr. Hooker was unanimously elected President of the Royal Society, which office he filled till 1878, when the claims of scientific work led him to resign that onerous post. In 1877 he

was created Knight Commander of the Star of India, for his many services to the Government of India, especially in connection with the growth of plants of economic value.

We have not yet referred to one of the greatest of Sir Joseph Hooker's undertakings, namely the preparation, with Mr. George Bentham, of an entirely new "Genera Plantarum," or complete set of Latin definitions and descriptions of all known genera of flowering plants. This work was prosecuted by both botanists with great perseverance for many years, and when published it at once became the standard work on the subject.

We can only enumerate a few of the many honours which have been conferred on Sir Joseph Hooker. In 1854 he was awarded a Royal Medal, in 1887 the Copley Medal of the Royal Society, in 1883 the Founder's Medal of the Royal Geographical Society, and in 1888 that of the Linnean Society. In 1883 he received from the Society of Arts their Albert Medal for his services to the arts, manufactures, and commerce, notably in adding to our knowledge of the vegetable products of various countries, especially within the British Empire. The Institute of France has numbered him amongst its corresponding members for many years. Honorary D.C.L. or LL.D. degrees have been conferred on him by Oxford, Cambridge, Dublin, Edinburgh and Glasgow Universities.

In conclusion, the Editor desires to thank Sir Joseph Hooker for his careful revision of the text, and for permitting his portrait to be given as a frontispiece.

G. T. B.

PREFACE.

HAVING accompanied Sir James Ross on his voyage of discovery to the Antarctic regions, where botany was my chief pursuit, on my return I earnestly desired to add to my acquaintance with the natural history of the temperate zones, more knowledge of that of the tropics than I had hitherto had the opportunity of acquiring. My choice lay between India and the Andes, and I decided upon the former, being principally influenced by Dr. Falconer, who promised me every assistance that his position as Superintendent of the H. E. I. C. Botanic Garden at Calcutta, would enable him to give. He also drew my attention to the fact that we were ignorant even of the geography of the central and eastern parts of these mountains, while all to the north was involved in a mystery equally attractive to the traveller and the naturalist.

On hearing of the kind interest taken by Baron Humboldt in my proposed travels, and at the request of my father (Sir William Hooker), the Earl of Carlisle (then Chief Commissioner of Woods and Forests) undertook to represent to Her Majesty's Government the expediency of securing my collections for the Royal Gardens at Kew; and owing to the generous exertions of that nobleman, and of the late Earl of Auckland (then First Lord of the Admiralty), my journey assumed the character of a Government mission, £400 per annum being granted by the Treasury for two years.

I did not contemplate proceeding beyond the Himalaya and Tibet, when Lord Auckland desired that I should afterwards visit Borneo, for the purpose of reporting on the capabilities of Labuan, with reference to the cultivation of cotton, tobacco, sugar, indigo, spices, guttapercha, &c. To this end a commission in the navy (to which service I was already attached) was given me, such instructions were drawn up as might facilitate my movements in the East, and a suitable sum of money was placed at my disposal.

Soon after leaving England, my plans became, from various causes, altered. The Earl of Auckland [1] was dead; the interest in Borneo had in a great measure subsided; H.M.S. *Meander*, to which I had been attached for service in Labuan, had left the Archipelago; reports of the unhealthy nature of the coast had excited alarm; and the results of my researches in the Himalaya had proved of more interest and advantage than had been anticipated. It was hence thought expedient to cancel the Borneo appointment, and to prolong my services for a third year in India; for which purpose a grant of £300 (originally intended for defraying the expense of collecting only, in Borneo) was transferred as salary for the additional year to be spent in the Himalaya.

The portion of the Himalaya best worth exploring was selected for me both by Lord Auckland and Dr. Falconer, who independently recommended Sikkim, as being ground untrodden by traveller or naturalist. Its ruler was, moreover, all but a dependant of the British Government, and it was supposed would therefore be glad to facilitate my researches.

No part of the snowy Himalaya eastward of the north-west extremity of the British possessions had been visited since Turner's embassy to Tibet in 1789; and hence it was highly important to explore scientifically a part of the chain which, from its central position, might be presumed to be typical of the whole range. The possibility of visiting Tibet, and of ascertaining particulars respecting the great mountain Chumulari,[2] which was only known from Turner's account, were additional inducements to a student of physical geography; but it was not then known that

[1] It is with a melancholy satisfaction that I here record the intentions of that enlightened nobleman. The idea of turning to public account what was intended as a scientific voyage, occurred to his lordship when considering my application for official leave to proceed to India; and from the hour of my accepting the Borneo commission with which he honoured me, he displayed the most active zeal in promoting its fulfilment. He communicated to me his views as to the direction in which I should pursue my researches, furnished me with official and other information, and provided me with introductions of the most essential use.

[2] My earliest recollections in reading are of "Turner's Travels in Tibet," and of "Cook's Voyages." The account of Lama worship and of Chumulari in the one, and of Kerguelen's Land in the other, always took a strong hold on my fancy. It is, therefore, singular that Kerguelen's Land should have been the first strange country I ever visited (now fourteen years ago), and that in the first King's ship which has touched there since Cook's voyage, and whilst following the track of that illustrious navigator in south polar discovery. At a later period I have been nearly the first European who has approached Chumulari since Turner's embassy.

Kinchinjunga, the loftiest known mountain on the globe,[1] was situated on my route, and formed a principal feature in the physical geography of Sikkim.

My passage to Egypt was provided by the Admiralty in H.M. steam-vessel *Sidon*, destined to convey the Marquis of Dalhousie, Governor-General of India, thus far on his way. On his arrival in Egypt, his Lordship did me the honour of desiring me to consider myself in the position of one of his suite for the remainder of the voyage, which was performed in the *Moozuffer*, a steam frigate belonging to the Indian Navy. My obligations to this nobleman had commenced before leaving England, by his promising me every facility he could command; and he thus took the earliest opportunity of affording it, by giving me such a position near himself as ensured me the best reception everywhere; no other introduction being needed. His Lordship procured my admission into Sikkim, and honoured me throughout my travels with the kindest encouragement.

During the passage out, some days were spent in Egypt, at Aden, Ceylon, and Madras. I have not thought it necessary to give here the observations made in those well-known countries; they are detailed in a series of letters published in the *London Journal of Botany*, as written for my private friends. Arriving at Calcutta in January, I passed the remainder of the cold season in making myself acquainted with the vegetation of the plains and hills of Western Bengal, south of the Ganges, by a journey across the mountains of Birbhoom and Behar to the Soane valley, and thence over the Vindhya range to the Ganges, at Mirzapore, whence I descended that stream to Bhaugulpore; and leaving my boat, struck north to the Sikkim Himalaya. This excursion is detailed in the *London Journal of Botany*, and the Asiatic Society of Bengal honoured me by printing the meteorological observations made during its progress.

During the two years' residence in Sikkim which succeeded, I was laid under obligations of no ordinary nature to Brian H. Hodgson, Esq., B.C.S., for many years Resident at the Nepal Court; whose guest I became for several months. Mr. Hodgson's high position as a man of science requires no mention here; but the difficulties he overcame, and the sacrifices he made, in attaining that position, are known to few. He entered the wilds of Nepal when very young, and in indifferent health; and finding time to spare, cast about for the best method of employing it: he

[1] Since the above was written, Mount Everest in Nepal has proved to be a few hundred feet higher than Kinchinjunga.

had no one to recommend or direct a pursuit, no example to follow, no rival to equal or surpass; he had never been acquainted with a scientific man, and knew nothing of science except the name. The natural history of men and animals, in its most comprehensive sense, attracted his attention; he sent to Europe for books, and commenced the study of ethnology and zoology. His labours have now extended over upwards of twenty-five years' residence in the Himalaya. During this period he has seldom had a staff of less than from ten to twenty persons (often many more), of various tongues and races, employed as translators and collectors, artists, shooters, and stuffers. By unceasing exertions and a princely liberality, Mr. Hodgson has unveiled the mysteries of the Boodhist religion, chronicled the affinities, languages, customs, and faiths of the Himalayan tribes; and completed a natural history of the animals and birds of these regions. His collections of specimens are immense, and are illustrated by drawings and descriptions taken from life, with remarks on the anatomy,[1] habits, and localities of the animals themselves. Twenty volumes of the Journals, and the Museum of the Asiatic Society of Bengal, teem with the proofs of his indefatigable zeal; and throughout the cabinets of the bird and quadruped departments of our national museum, Mr. Hodgson's name stands pre-eminent. A seat in the Institute of France, and the cross of the Legion of Honour, prove the estimation in which his Boodhist studies are held on the continent of Europe. To be welcomed to the Himalaya by such a person, and to be allowed the most unreserved intercourse, and the advantage of all his information and library, exercised a material influence on the progress I made in my studies, and on my travels. When I add that many of the subjects treated of in these volumes were discussed between us, it will be evident that it is impossible for me to divest much of the information thus insensibly obtained, of the appearance of being the fruits of my own research.

Dr. Campbell, the Superintendent of Darjeeling, is likewise the Governor-General's agent, or medium of communication between the British Government and the Sikkim Rajah; and as such, invested with many discretionary powers. In the course of this narrative I shall give a sketch of the rise, progress, and prospects of the Sanatarium, or Health-station of Darjeeling, and of the anomalous position held by the Sikkim Rajah. The latter cir-

[1] In this department he availed himself of the services of Dr. Campbell, who was also attached to the Residency at Nepal, as surgeon and assistant political agent.

cumstance led indirectly to the detention of Dr. Campbell (who joined me in one of my journeys) and myself, by a faction of the Sikkim court, for the purpose of obtaining from the Indian Government a more favourable treaty than that then existing. This mode of enforcing a request by *douce violence* and detention is common with the turbulent tribes east of Nepal, but was in this instance aggravated by violence towards my fellow-prisoner, through the ill-will of the persons who executed the orders of their superiors, and who had been punished by Dr. Campbell for crimes committed against both the British and Nepalese governments. The circumstances of this outrage were misunderstood at the time; its instigators were supposed to be Chinese; its perpetrators Tibetans; and we the offenders were assumed to have thrust ourselves into the country, without authority from our own government, and contrary to the will of the Sikkim Rajah; who was imagined to be a tributary of China, and protected by that nation, and to be under no obligation to the East Indian Government.

With regard to the obligations I owe to Dr. Campbell, I confine myself to saying that his whole aim was to promote my comfort, and to secure my success, in all possible ways. Every object I had in view was as sedulously cared for by him as by myself: I am indebted to his influence with Jung Bahadoor[1] for the permission to traverse his dominions, and to visit the Tibetan passes of Nepal. His prudence and patience in negotiating with the Sikkim court, enabled me to pursue my investigations in that country. My journal is largely indebted to his varied and extensive knowledge of the people and productions of these regions.

In all numerical calculations connected with my observations, I received most essential aid from John Muller, Esq., Accountant of the Calcutta Mint, and from his brother, Charles Muller, Esq., of Patna, both ardent amateurs in scientific pursuits, and who employed themselves in making meteorological observations at Darjeeling, where they were recruiting constitutions impaired by the performance of arduous duties in the climate of the plains. I cannot sufficiently thank these gentlemen for the handsome manner in which they volunteered me their assistance in these laborious operations. Mr. J. Muller resided at Darjeeling during eighteen months of my stay in Sikkim, over the whole of which

[1] It was in Nepal that Dr. Campbell gained the friendship of Jung Bahadoor, the most remarkable proof of which is the acceding to his request, and granting me leave to visit the eastern parts of his dominions; no European that I am aware of, having been allowed, either before or since, to travel anywhere except to and from the plains of India and valley of Katamandu, in which the capital city and British residency are situated.

period his generous zeal in my service never relaxed ; he assisted me in the reduction of many hundreds of my observations for latitude, time, and elevation, besides adjusting and rating my instruments; and I can recall no more pleasant days than those thus spent with these hospitable friends.

Thanks to Dr. Falconer's indefatigable exertions, such of my collections as reached Calcutta were forwarded to England in excellent order; and they were temporarily deposited in Kew Gardens until their destination should be determined. On my return home, my scientific friends interested themselves in procuring from the Government such aid as might enable me to devote the necessary time to the arrangement, naming, and distributing of my collections, the publication of my manuscripts, &c. I am in this most deeply indebted to the disinterested and generous exertions of Mr. L. Horner, Sir Charles Lyell, Dr. Lindley, Professor E. Forbes, and many others ; and most especially to the Presidents of the Royal Society (the Earl of Rosse), of the Linnean (Mr. R. Brown), and Geological (Mr. Hopkins), who in their official capacities memorialized in person the Chief Commissioner of Woods and Forests on this subject ; Sir William Hooker at the same time bringing it under the notice of the First Lord of the Treasury. The result was a grant of £400 annually for three years.

Dr. T. Thomson joined me in Darjeeling in the end of 1849, after the completion of his arduous journeys in the North-West Himalaya and Tibet, and we spent the year 1850 in travelling and collecting, returning to England together in 1851. Having obtained permission from the Indian Government to distribute his botanical collections, which equal my own in extent and value, we were advised by all our botanical friends to incorporate, and thus to distribute them. The whole constitute an Herbarium of from 6,000 to 7,000 species of Indian plants, including an immense number of duplicates ; and it is now in process of being arranged and named by Dr. Thomson and myself, preparatory to its distribution amongst sixty of the principal public and private herbaria in Europe, India, and the United States of America.

For the information of future travellers, I may state that the total expense of my Indian journey, including outfit, three years and a half travelling, and the sending of my collections to Calcutta, was under £2,000 (of which £1,200 were defrayed by Government), but would have come to much more had I not enjoyed the great advantages I have detailed. This sum does not include the purchase of books and instruments, with which I

supplied myself, and which cost about £200, nor the freight of the collections to England, which was paid by Government. Owing to the kind services of Mr. J. C. Melvill, Secretary of the India House, many small parcels of seeds, &c., were conveyed to England free of cost; and I have to record my great obligations and sincere thanks to the Peninsular and Oriental Steam Navigation Company, for conveying, without charge, all small parcels of books, instruments and specimens, addressed to or by myself.

It remains to say something of the illustrations of this work. The maps are from surveys of my own, made chiefly with my own instruments, but partly with some valuable ones for the use of which I am indebted to my friend Captain (now Sir H.) Thuillier, Deputy Surveyor-General of India, who placed at my disposal the resources of the magnificent establishment under his control, and to whose innumerable good offices I am very greatly beholden.

The landscapes, &c., have been prepared chiefly from my own drawings, and will, I hope, be found to be tolerably faithful representations of the scenes. I have always endeavoured to overcome that tendency to exaggerate heights, and increase the angle of slopes, which is I believe the besetting sin, not of amateurs only, but of our most accomplished artists. As, however, I did not use instruments in projecting the outlines, I do not pretend to have wholly avoided this snare; nor, I regret to say, has the lithographer, in all cases, been content to abide by his copy. My drawings will be considered tame compared with most mountain landscapes, though the subjects comprise some of the grandest scenes in nature. Considering how conventional the treatment of such subjects is, and how unanimous artists seem to be as to the propriety of exaggerating those features which should predominate in the landscape, it may fairly be doubted whether the total effect of steepness and elevation, especially in a mountain view, can, on a small scale, be conveyed by a strict adherence to truth. I need hardly add, that if such is attainable, it is only by those who have a power of colouring that few pretend to. In the list of plates and woodcuts I have mentioned the obligations I am under to several friends for the use of drawings, &c.

With regard to the spelling of native names, after much anxious discussion I have adopted that which assimilates most to the English pronunciation. For great assistance in this, for a careful revision of the sheets as they passed through the press, and for numerous valuable suggestions throughout, I am indebted to my fellow-traveller, Dr. Thomas Thomson.

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MAPS.

1. A GENERAL MAP OF LOWER AND EASTERN BENGAL, WITH THE HIMALAYA AND ADJACENT PROVINCES OF TIBET.

The Tibetan portion of this map is to a great extent conjectural, and is intended to convey a general idea of the arrangement of the mountains, according to the information collected by Dr. Campbell and myself, and to show the position of the principal groups of snowed peaks between the Yaru-tsampu and the plains of India, and their relations to the water-shed of the Himalaya.

The positions and direction of the minor spurs of the mountain ranges of Central India and Behar are also, to a great extent, conjectural. It is particularly requisite to observe, that the only object of this map is to give a better general idea of the physical-geography of South-eastern Tibet and Central India, from the materials at my command, and hence to afford a better guide to the understanding of some of the points I have attempted to explain in these volumes, than is obtainable from any map with which I am acquainted.

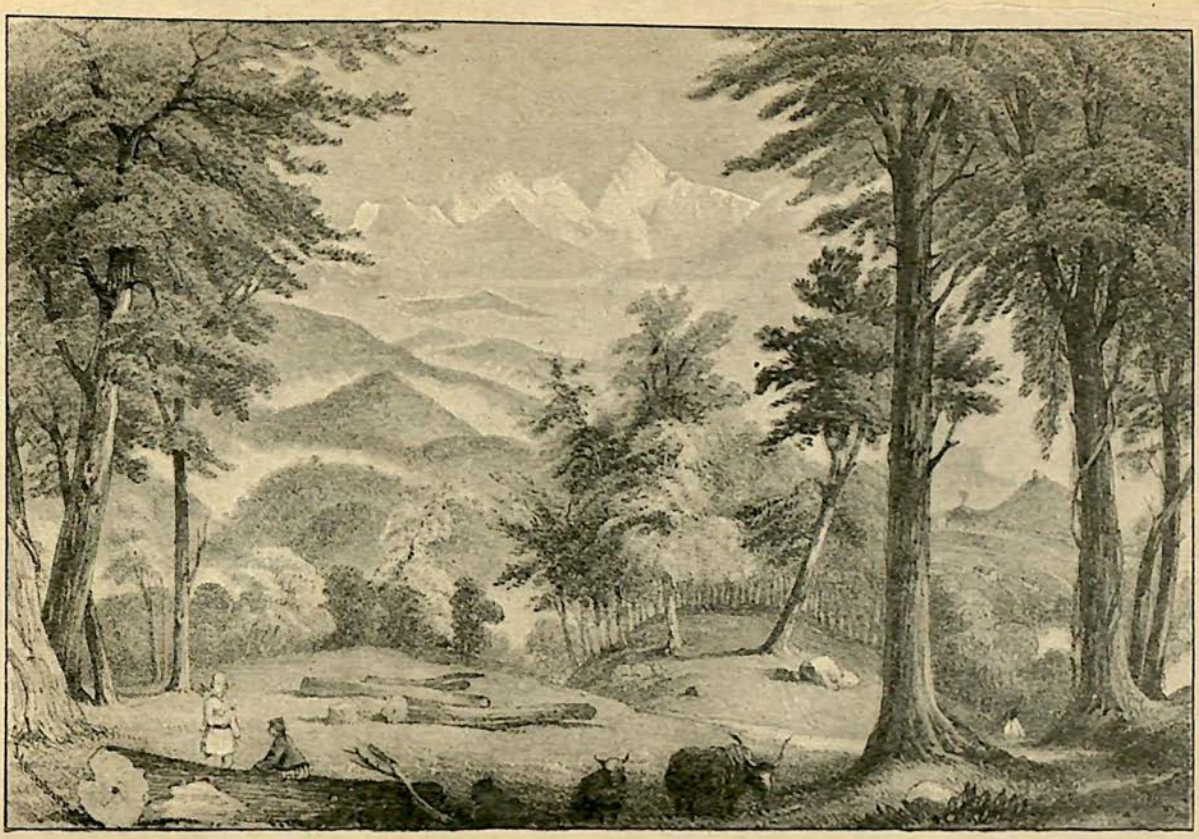
Above the map is a view of the Sikkim Himalaya, from Nango to Donkia, as seen from Darjeeling. On the right are four views of celebrated mountains, as seen from great distances:—

1. CHUMULARI, FROM TONGLO.
2. KINCHINJUNGA, FROM EAST NEPAL.
3. DITTO FROM BHOMTSO IN TIBET.
4. THE GHASSA MOUNTAINS, TIBET, FROM BHOMTSO IN TIBET.

On the left is a survey of the moraines, &c., in the Yangma valley, as described in p. 161.

I beg to return my acknowledgments to Mr. Petermann for the skill and care which he has devoted to the construction of this map. The scale is approximate only, and perhaps very erroneous.

2. GENERAL MAP OF SIKKIM, ETC., FROM A SURVEY BY THE AUTHOR.



KINCHINJUNGA FROM DARJEELING.

HIMALAYAN JOURNALS.

CHAPTER I.

Sunderbunds vegetation—Calcutta Botanic Garden—Leave for Burdwan—Rajah's gardens and menagerie—Coal-beds, geology, and plants of—Lac insect and plant—Camels—Kunker—Cowage—Effloresced soda on soil—Glass, manufacture of—Atmospheric vapours—Temperature, &c.—Mahowa oil and spirits—Maddaobund—Jains—Ascent of Paras-nath—Vegetation of that mountain.

I LEFT England on the 11th of November, 1847, and performed the voyage to India under circumstances which have been detailed in the Introduction. On the 12th of January, 1848, the *Moozuffer* was steaming amongst the low, swampy islands of the Sunderbunds. These exhibit no tropical luxuriance, and are, in this respect, exceedingly disappointing. A low vegetation covers them, chiefly made up of a dwarf-palm (*Phœnix paludosa*) and small mangroves, and with a few scattered trees on the higher bank that runs along the water's edge, consisting of fan-palm, toddy-palm, and *Terminalia*. Every now and then the paddles of the steamer tossed up the large fruits of *Nipa fruticans*, a low, stemless palm that grows in the tidal waters of the Indian ocean, and bears a large head of nuts. It is a plant of no interest to the common observer, but of much to the geologist, from the nuts of a similar plant abounding in the tertiary formations at the mouth of the Thames, and having floated about there in as great profusion as here, till buried deep in the silt and mud that now forms the island of Sheppey.[1]

Higher up, the river Hoogly is entered, and large trees, with

[1] Bowerbank "On the Fossil Fruits and Seeds of the Isle of Sheppey," and Lyell's "Elements of Geology," 3rd ed. p. 201.

villages and cultivation, replace the sandy spits and marshy jungles of the great Gangetic delta. A few miles below Calcutta, the scenery becomes beautiful, beginning with the Botanic Garden, once the residence of Roxburgh and Wallich, and now of Falconer —classical ground to the naturalist. Opposite are the gardens of Sir Lawrence Peel; unrivalled in India for their beauty and cultivation, and fairly entitled to be called the Chatsworth of Bengal. A little higher up, Calcutta opened out, with the batteries of Fort William in the foreground, thundering forth a salute, and in a few minutes more all other thoughts were absorbed in watching the splendour of the arrangements made for the reception of the Governor-General of India.

During my short stay in Calcutta I was principally occupied in preparing for an excursion with Mr. Williams of the Geological Survey, who was about to move his camp from the Damooda valley coal-fields, near Burdwan, to Beejaghur on the banks of the Soane, where coal was reported to exist, in the immediate vicinity of water-carriage, the great desideratum of the Burdwan fields.

My time was spent partly at Government-House, and partly at Sir Lawrence Peel's residence. The former I was kindly invited to consider as my Indian home, an honour which I appreciate the more highly as the invitation was accompanied with the assurance that I should have entire freedom to follow my own pursuits; and the advantages which such a position afforded me, were, I need not say, of no ordinary kind.

At the Botanic Gardens I received every assistance from Dr. McLelland,[1] who was very busy, superintending the publication of the botanical papers and drawings of his friend, the late Dr. Griffith, for which native artists were preparing copies on lithographic paper.

Of the Gardens themselves it is exceedingly difficult to speak; the changes had been so very great, and from a state with which I had no acquaintance. There had been a great want of judgment in the alterations made since Dr. Wallich's time, when they were celebrated as the most beautiful gardens in the East, and were the great object of attraction to strangers and townspeople. I found instead an unsightly wilderness, without shade (the first requirement of every tropical garden) or other beauties than some isolated grand trees, which had survived the indiscriminate destruction of the useful and ornamental which had attended the well-meant but ill-judged attempt to render a garden a botanical class-book. It is impossible to praise too highly Dr. Griffith's abilities and ac-

[1] Dr. Falconer's *locum tenens*, then in temporary charge of the establishment.

quirements as a botanist, his perseverance and success as a traveller, or his matchless industry in the field and in the closet; and it is not wonderful, that, with so many and varied talents, he should have wanted the eye of a landscape-gardener, or the education of a horticulturist. I should, however, be wanting in my duty to his predecessor, and to his no less illustrious successor, were these remarks withheld, proceeding, as they do, from an unbiassed observer, who had the honour of standing in an equally friendly relation to all parties. Before leaving India I saw great improvements, but many years must elapse before the gardens can resume their once proud pre-eminence.

I was surprised to find the Botanical Garden looked upon by many of the Indian public, and even by some of the better informed official men, as rather an extravagant establishment, more ornamental than useful. These persons seemed astonished to learn that its name was renowned throughout Europe, and that during the first twenty years especially of Dr. Wallich's superintendence, it had contributed more useful and ornamental tropical plants to the public and private gardens of the world than any other establishment before or since.[1] I speak from a personal knowledge of the contents of our English gardens, and our colonial ones at the Cape, and in Australia, and from an inspection of the ponderous volumes of distribution lists, to which Dr. Falconer is daily adding. The botanical public of Europe and India is no less indebted than the horticultural to the liberality of the Hon. East India Company, and to the energy of the several eminent men who have carried its views into execution.[2] The Indian

[1] As an illustration of this, I may refer to a Report presented to the government of Bengal, from which it appears that between January, 1836, and December, 1840, 189,932 plants were distributed gratis to nearly 2,000 different gardens.

[2] I here allude to the great Indian herbarium, chiefly formed by the staff of the Botanic Gardens under the direction of Dr. Wallich, and distributed in 1829 to the principal museums of Europe. This is the most valuable contribution of the kind ever made to science, and it is a lasting memorial of the princely liberality of the enlightened men who ruled the counsels of India in those days. No botanical work of importance has been published since 1829, without recording its sense of the obligation, and I was once commissioned by a foreign government to purchase for its national museum, at whatever cost, one set of these collections, which was brought to the hammer on the death of its possessor. I have heard it remarked that the expense attending the distribution was enormous, and I have reason to know that this erroneous impression has had an unfavourable influence upon the destination of scarcely less valuable collections, which have for years been lying untouched in the cellars of the India House. I may add that officers who have exposed their lives and impaired their health in forming similar ones at the orders and expense of the Indian govern-

government, itself, has already profited largely by these gardens, directly and indirectly, and might have done so still more, had its efforts been better seconded either by the European or native population of the country. Amongst its greatest triumphs may be considered the introduction of the tea-plant from China, a fact I allude to as many of my English readers may not be aware that the establishment of the tea-trade in the Himalaya and Assam is almost entirely the work of the superintendents of the gardens of Calcutta and Saharunpore.

From no one did I receive more kindness than from Sir James Colvile, President of the Asiatic Society, who not only took care that I should be provided with every comfort, but presented me with a completely equipped palkee, which, for strength and excellence of construction, was everything that a traveller could desire. Often *en route* did I mentally thank him when I saw other palkees breaking down, and travellers bewailing the loss of those forgotten necessaries with which his kind attention had furnished me.

I left Calcutta to join Mr. Williams' camp on the 28th of January, driving to Hoogly on the river of that name, and thence following the grand trunk-road westward towards Burdwan. The novelty of palkee-travelling at first renders it pleasant; the neatness with which everything is packed, the good-humour of the bearers, their merry pace, and the many more comforts enjoyed than could be expected in a conveyance *horsed by men*, the warmth when the sliding doors are shut, and the breeze when they are opened, are all fully appreciated on first starting; but soon the novelty wears off, and the discomforts are so numerous, that it is pronounced, at best, a barbarous conveyance. The greedy cry and gestures of the bearers, when, on changing, they break a fitful sleep by poking a torch in your face, and vociferating "Baksheesh, Sahib;" their discontent at the most liberal largesse, and the sluggishness of the next set who want bribes, put the traveller out of patience with the natives. The dust when the slides are open, and the stifling heat when shut during a shower, are conclusive against the vehicle, and on getting out with aching bones and giddy head at the journey's end, I shook the dust from my person, and wished never to see a palkee again.

On the following morning I was passing through the straggling

ment, are at home, and thrown upon their own resources, or the assistance of their scientific brethren, for the means of publishing and distributing the fruits of their labours.

villages close to Burdwan, consisting of native hovels by the roadside, with mangos and figs planted near them, and palms waving over their roofs. Crossing the nearly dry bed of the Damooda, I was set down at Mr. M'Intosh's (the magistrate of the district), and never more thoroughly enjoyed a hearty welcome and a breakfast.

In the evening we visited the Rajah of Burdwan's palace and pleasure-grounds, where I had the first glimpse of Oriental gardening: the roads were generally raised, running through rice-fields, now dry and hard, and bordered with trees of Jack, Bamboo, *Melia*, *Casuarina*, &c. Tanks were the prominent features: chains of them, full of Indian water-lilies, being fringed with rows of the fan-palm, and occasionally the Indian date. Close to the house was a rather good menagerie, where I saw, amongst other animals, a pair of kangaroos in high health and condition, the female with young in her pouch. Before dark I was again in my palkee, and hurrying onwards. The night was cool and clear, very different from the damp and foggy atmosphere I had left at Calcutta. On the following morning I was travelling over a flat and apparently rising country, along an excellent road, with groves of bamboos and stunted trees on either hand, few villages or palms, a sterile soil, with stunted grass and but little cultivation; altogether a country as unlike what I had expected to find in India as well might be. All around was a dead flat or table-land, out of which a few conical hills rose in the west, about 1,000 feet high, covered with a low forest of dusky green or yellow, from the prevalence of bamboo. The lark was singing merrily at sunrise, and the accessories of a fresh air and dewy grass more reminded me of some moorland in the north of England than of the torrid regions of the east.

At 10 P.M. I arrived at Mr. Williams' camp, at Taldangah, a dawk station near the western limit of the coal basin of the Damooda valley. His operations being finished, he was prepared to start, having kindly waited a couple of days for my arrival.

Early on the morning of the last day of January a motley group of natives were busy striking the tents, and loading the bullocks, bullock-carts, and elephants; these proceeded on the march, occupying in straggling groups nearly three miles of road, whilst we remained to breakfast with Mr. F. Watkins, Superintendent of the East India Coal and Coke Company, who were working the seams.

The coal crops out at the surface; but the shafts worked are sunk through thick beds of alluvium. The age of these coal-fields

is quite unknown, and I regret to say that my examination of their fossil plants throws no material light on the subject. Upwards of thirty species of fossil plants have been procured from them, and of these the majority are referred by Dr. McLelland [1] to the inferior oolite epoch of England, from the prevalence of species of *Zamia*, *Glossopteris*, and *Tæniopteris*. Some of these genera, together with *Vertebraria* (a very remarkable Indian fossil), are also recognised in the coal-fields of Sind and of Australia. I cannot, however, think that botanical evidence of such a nature is sufficient to warrant a satisfactory reference of these Indian coal-fields to the same epoch as those of England or Australia; in the first place the outlines of the fronds of ferns and their nervation are frail characters if employed alone for the determination of existing genera, and much more so of fossil fragments; in the second place recent ferns are so widely distributed, that an inspection of the majority affords little clue to the region or locality they come from; and in the third place, considering the wide difference in latitude and longitude of Yorkshire, India, and Australia, the natural conclusion is that they could not have supported a similar vegetation at the same epoch. In fact, finding similar fossil plants at places widely different in latitude, and hence in climate, is, in the present state of our knowledge, rather an argument against than for their having existed cotemporaneously. The *Cycadeæ* especially, whose fossil remains afford so much ground for geological speculations, are far from yielding such precise data as is supposed. Species of the order are found in Mexico, South Africa, Australia, and India, some inhabiting the hottest and dampest, and others the driest climates on the surface of the globe; and it appears to me rash to argue much from the presence of the order in the coal of Yorkshire and India, when we reflect that the geologist of some future epoch may find as good reasons for referring the present Cape, Australian, or Mexican Flora to the same period as that of the Lias and Oolites, when the *Cycadeæ* now living in the former countries shall be fossilised.

Specific identity of their contained fossils may be considered as fair evidence of the cotemporaneous origin of beds, but amongst the many collections of fossil plants that I have examined, there is hardly a specimen, belonging to any epoch, sufficiently perfect to warrant the assumption that the species to which it belonged can be again recognised. The botanical evidences which geologists too often accept as proofs of specific identity are such as no botanist would attach any importance to in the investigation

[1] Reports of the Geological Survey of India. Calcutta, 1850.

of existing plants. The faintest traces assumed to be of vegetable origin are habitually made into genera and species by naturalists ignorant of the structure, affinities and distribution of living plants, and of such materials the bulk of so-called systems of fossil plants is composed.

A number of women were here employed in making gunpowder, grinding the usual materials on a stone, with the addition of water from the Hookah; a custom for which they have an obstinate prejudice. The charcoal here used is made from an *Acacia:* the Seiks, I believe, employ *Justicia Adhatoda*, which is also in use all over India: at Aden the Arabs prefer the *Calotropis*, probably because it is most easily procured. The grain of all these plants is open, whereas in England, closer-grained and more woody trees, especially willows, are preferred.

The jungle I found to consist chiefly of thorny bushes, Jujube of two species, an *Acacia* and *Butea frondosa*, the twigs of the latter often covered with lurid red tears of Lac, which is here collected in abundance. As it occurs on the plants and is collected by the natives it is called Stick-lac, but after preparation Shell-lac. In Mirzapore, a species of *Celtis* yields it, and the Peepul very commonly in various parts of India. The elaboration of this dye, whether by the same species of insect, or by many from plants so widely different in habit and characters, is a very curious fact; since none have red juice, but some have milky and others limpid.

After breakfast, Mr. Williams and I started on an elephant, following the camp to Gyra, twelve miles distant. The docility of these animals is an old story, but it loses so much in the telling, that their gentleness, obedience, and sagacity seemed as strange to me as if I had never heard or read of these attributes. The swinging motion, under a hot sun, is very oppressive, but compensated for by being so high above the dust. The Mahout, or driver, guides by poking his great toes under either ear, enforcing obedience with an iron goad, with which he hammers the animal's head with quite as much force as would break a cocoa-nut, or drives it through his thick skin down to the quick. A most disagreeable sight it is, to see the blood and yellow fat oozing out in the broiling sun from these great punctures! Our elephant was an excellent one, when he did not take obstinate fits, and so docile as to pick up pieces of stone when desired, and with a jerk of the trunk throw them over his head for the rider to catch, thus saving the trouble of dismounting to geologise!

Of sights on the road, unfrequented though this noble line is,

there were plenty for a stranger; chiefly pilgrims to Juggernath, most on foot, and a few in carts or pony gigs of rude construction. The vehicles from the upper country are distinguished by a far superior build, their horses are caparisoned with jingling bells, and the wheels and other parts are bound with brass. The kindness of the people towards animals, and in some cases towards their suffering relations, is very remarkable, and may in part have given origin to the prevalent idea that they are less cruel and stern than the majority of mankind; but that the "mild" Hindoo, however gentle on occasion, is cruel and vindictive to his brother man and to animals, when his indolent temper is roused or his avarice stimulated, no one can doubt who reads the accounts of Thuggee, Dacoitee, and poisoning, and witnesses the cruelty with which beasts of burthen are treated. A child carrying a bird, kid, or lamb, is not an uncommon sight, and a woman with a dog in her arms is still more frequently seen. Occasionally, too, a group will bear an old man to see Juggernath before he dies, or a poor creature with elephantiasis, who hopes to be allowed to hurry himself to his paradise, in preference to lingering in helpless inactivity, and at last crawling up to the second heaven only. The costumes are as various as the religious castes, and the many countries to which the travellers belong. Next in wealth to the merchants, the most thriving-looking wanderer is the bearer of Ganges' holy water, who drives a profitable trade, his gains increasing as his load lightens, for the further he wanders from the sacred stream, the more he gets for the contents of his jar.

Of merchandise we passed very little, the Ganges being still the high road between north-west India and Bengal. Occasionally a string of camels was seen, but, owing to the damp climate, these are rare, and unknown east of the meridian of Calcutta. A little cotton, clumsily packed in ragged bags, dirty, and deteriorating every day, even at this dry season, proves in how bad a state it must arrive at the market during the rains, when the low waggons are dragged through the streams.

The roads here are all mended with a curious stone, called Kunker, which is a nodular concretionary deposit of limestone, abundantly imbedded in the alluvial soil of a great part of India.[1] It resembles a coarse gravel, each pebble being often as large as a walnut, and tuberculated on the surface: it binds admirably, and forms excellent roads, but pulverises into a most disagreeable impalpable dust.

A few miles beyond Taldangah we passed from the sandstone,

[1] Often occurring in strata, like flints.

in which the coal lies, to a very barren country of gneiss and granite rocks, upon which the former rests; the country still rising, more hills appear, and towering far above all is Paras-nath, the culminant point, and a mountain whose botany I was most anxious to explore.

The vegetation of this part of the country is very poor, no good-sized trees are to be seen, all is a low stunted jungle. The grasses were few, and dried up, except in the beds of the rivulets. On the low jungly hills the same plants appear, with a few figs, bamboo in great abundance, several handsome *Acanthaceæ*; a few *Asclepiadeæ* climbing up the bushes; and the Cowage plant, now with over-ripe pods, by shaking which, in passing, there often falls such a shower of its irritating microscopic hairs, as to make the skin tingle for an hour.

On the 1st of February, we moved on to Gyra, another insignificant village. The air was cool, and the atmosphere clear. The temperature, at three in the morning, was 65°, with no dew, the grass only 61°. As the sun rose, Paras-nath appeared against the clear grey sky, in the form of a beautiful broad cone, with a rugged peak, of a deeper grey than the sky. It is a remarkably handsome mountain, sufficiently lofty to be imposing, rising out of an elevated country, the slope of which, upward to the base of the mountain, though imperceptible, is really considerable; and it is surrounded by lesser hills of just sufficient elevation to set it off. The atmosphere, too, of these regions is peculiarly favourable for views: it is very dry at this season; but still the hills are clearly defined, without the harsh outlines so characteristic of a moist air. The skies are bright, the sun powerful; and there is an almost imperceptible haze that seems to soften the landscape, and keep every object in true perspective.

Our route led towards the picturesque hills and valleys in front. The rocks were all hornblende and micaceous schist, cut through by trap-dykes, while great crumbling masses (or bosses) of quartz protruded through the soil. The stratified rocks were often exposed, pitched up at various inclinations; they were frequently white with effloresced salts, which entering largely into their composition tended to hasten their decomposition, and being obnoxious to vegetation, rendered the sterile soil more hungry still. There was little cultivation, and that little of the most wretched kind; even rice-fields were few and scattered; there was no corn, or gram (*Ervum Lens*), no Castor-oil, no Poppy, Cotton, Safflower, or other crops of the richer soils that flank the Ganges and Hoogly; a very little Sugar-cane, Dhal (*Cajana*), Mustard, Lin-

seed, and Rape, the latter three cultivated for their oil. Hardly a Palm was to be seen; and it was seldom that the cottages could boast of a Banana, Tamarind, Orange, Cocoa-nut or Date. The Mahowa (*Bassia latifolia*) and Mango were the commonest trees. There being no Kunker in the soil here, the roads were mended with angular quartz, much to the elephants' annoyance.

We dismounted where some very micaceous stratified rock cropped out, powdered with a saline efflorescence.[1] Jujubes (*Zizyphus*) prevailed, with the *Carissa carandas* (in fruit), a shrub belonging to the usually poisonous family of Dog-banes (*Apocyneæ*); its berries make good tarts, and the plant itself forms tolerable hedges.

The country around Fitcoree is rather pretty, the hills covered with bamboo and brushwood, and as usual, rising rather suddenly from the elevated plains. The jungle affords shelter to a few bears and tigers, jackals in abundance, and occasionally foxes; the birds seen are chiefly pigeons. Insects are very scarce; those of the locust tribe being most prevalent, indicative of a dry climate.

The temperature at 3 A.M. was 65°; at 3 P.M. 82°; and at 10 P.M., 68°, from which there was no great variation during the whole time we spent at these elevations. The clouds were rare, and always light and high, except a little fleecy spot of vapour condensed close to the summit of Paras-nath. Though the nights were clear and starlight, no dew was deposited, owing to the great dryness of the air. On one occasion, this drought was so great during the passage of a hot wind, that at night I observed the wet-bulb thermometer to stand 20½° below the temperature of the air, which was 66°; this indicated a dew-point of 11½°, or 54½° below the air, and a saturation-point of 0·146; there being only 0·102 grains of vapour per cubic foot of air, which latter was loaded with dust. The little moisture suspended in the atmosphere is often seen to be condensed in a thin belt of vapour, at a considerable distance above the dry surface of the earth, thus

[1] An impure carbonate of soda. This earth is thrown into clay vessels with water, which, after dissolving the soda, is allowed to evaporate, when the remainder is collected, and found to contain so much silica as to be capable of being fused into glass. Dr. Royle mentions this curious fact (Essay on the Arts and Manufactures of India, read before the Society of Arts, February 18, 1852), in illustration of the probably early epoch at which the natives of British India were acquainted with the art of making glass. More complicated processes are employed, and have been from a very early period, in other parts of the continent.

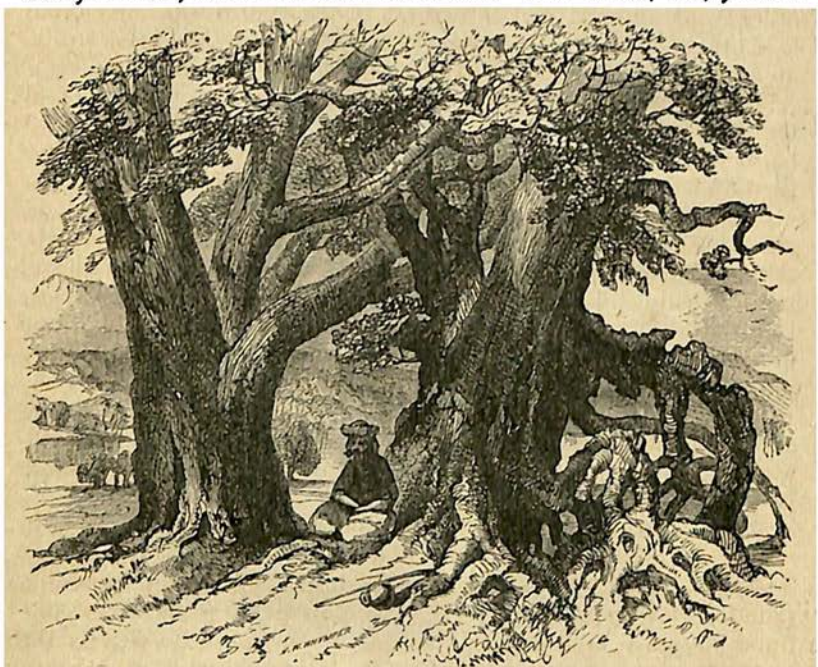
intercepting the radiation of heat from the latter to the clear sky above. Such strata may be observed, crossing the hills in ribbon-like masses, though not so clearly on this elevated region as on the plains bounding the lower course of the Soane, where the vapour is more dense, the hills more scattered, and the whole atmosphere more humid. During the ten days I spent amongst the hills I saw but one cloudy sunrise, whereas below, whether at Calcutta, or on the banks of the Soane, the sun always rose behind a dense fog-bank.

At 9½ A.M. the black-bulb thermometer rose in the sun to 130°. The morning observation before 10 or 11 A.M. always gives a higher result than at noon, though the sun's declination is so considerably less, and in the hottest part of the day it is lower still (3½ P.M. 109°), an effect no doubt due to the vapours raised by the sun, and which equally interfere with the photometer observations. The N.W. winds invariably rise at about 9 A.M. and blow with increasing strength till sunset; they are due to the rarefaction of the air over the heated ground, and being loaded with dust, the temperature of the atmosphere is hence raised by the heated particles. The increased temperature of the afternoon is therefore not so much due to the accumulation of caloric from the sun's rays, as to the passage of a heated current of air derived from the much hotter regions to the westward. It would be interesting to know how far this N.W. diurnal tide extends; also the rate at which it gathers moisture in its progress over the damp regions of the Sunderbunds. Its excessive dryness in N.W. India approaches that of the African and Australian deserts.

On the 2nd of February we proceeded to Tofe-Choney, the hills increasing in height to nearly 1,000 feet, and the country becoming more picturesque. We passed some tanks covered with *Villarsia*, and frequented by flocks of white egrets. The existence of artificial tanks so near a lofty mountain, from whose sides innumerable water-courses descend, indicates the great natural dryness of the country during one season of the year. The hills and valleys were richer than I expected, though far from luxuriant. A fine *Nauclea* is a common shady tree, and *Bignonia indica*, now leafless, but with immense pods hanging from the branches. *Acanthaceæ* is the prevalent natural order, consisting of gay-flowered *Eranthemums*, *Ruellias*, *Barlerias*, and such hothouse favourites.[1]

[1] Other plants gathered here, and very typical of the Flora of this dry region, were *Linum trigynum*, *Feronia elephantum*, *Ægle marmelos*, *Helicteres Asoca*, *Abrus precatorius*, *Flemingia*; various *Desmodia*, *Rhynchosiæ*, *Glycine*, and

This being the most convenient station whence to ascend Paras-nath, we started at 6 A.M. for the village of Maddaobund, at the north base of the mountain, or opposite side from that on which the grand trunk-road runs. After following the latter for a few miles to the west, we took a path through beautifully wooded plains, with scattered trees of the Mahowa (*Bassia latifolia*), resembling good oaks: the natives distil a kind of arrack from its fleshy flowers, which are also eaten raw. The seeds, too, yield a



OLD TAMARIND TREES.

concrete oil, by expression, which is used for lamps and occasionally for frying.

Some villages at the west base of the mountain occupy a better soil, and are surrounded with richer cultivation; palms, mangos, and the tamarind, the first and last rare features in this part of Bengal, appeared to be common, with fields of rice and broad

Grislea tomentosa very abundant, *Conocarpus latifolius*, *Loranthus longiflorus*, and another species; *Phyllanthus Emblica*, various *Convolvuli*, *Cuscuta*, and several herbaceous *Compositæ*.

acres of flax and rape, through the latter of which the blue *Orobanche indica* swarmed. The short route to Maddaobund, through narrow rocky valleys, was impracticable for the elephants, and we had to make a very considerable détour, only reaching that village at 2 P.M. All the hill people we observed were a fine-looking athletic race; they disclaimed the tiger being a neighbour, which every palkee-bearer along the road declares to carry off the torch-bearers, torch and all. Bears they said were scarce, and all other wild animals, but a natural jealousy of Europeans often leads the natives to deny the existence of what they know to be an attraction to the proverbially sporting Englishman.

The site of Maddaobund, elevated 1,230 feet, in a clearance of the forest, and the appearance of the snow-white domes and bannerets of its temples through the fine trees by which it is surrounded, are very beautiful. Though several hundred feet above any point we had hitherto reached, the situation is so sheltered that the tamarind, peepul, and banyan trees are superb. A fine specimen of the latter stands at the entrance to the village, not a broad-headed tree, as is usual in the prime of its existence, but a mass of trunks irregularly throwing out immense branches in a most picturesque manner; the original trunk is apparently gone, and the principal mass of root stems is fenced in. This, with two magnificent tamarinds, forms a grand clump. The ascent of the mountain is immediately from the village up a path-way worn by the feet of many a pilgrim from the most remote parts of India.

Paras-nath is a mountain of peculiar sanctity, to which circumstance is to be attributed the flourishing state of Maddaobund. The name is that of the twenty-third incarnation of Jinna (Sanscrit "Conqueror"), who was born at Benares, lived one hundred years, and was buried on this mountain, which is the eastern metropolis of Jain worship, as Mount Aboo is the western (where are their libraries and most splendid temples). The origin of the Jain sect is obscure, though its rise appears to correspond with the wreck of Boodhism throughout India in the eleventh century. The Jains form in some sort a transition-sect between Boodhists and Hindoos, differing from the former in acknowledging castes, and from both in their worship of Paras-nath's foot, instead of that of Munja-gosha of the Boodhs, or Vishnoo's of the Hindoos. As a sect of Boodhists their religion is considered pure, and free from the obscenities so conspicuous in Hindoo worship; whilst, in fact, perhaps the reverse is the case; but the symbols are fewer, and indeed almost confined to

the feet of Paras-nath, and the priests jealously conceal their esoteric doctrines.

The temples, though small, are well built, and carefully kept. No persuasion could induce the Brahmins to allow us to proceed beyond the vestibule without taking off our shoes, to which we were not inclined to consent. The bazaar was for so small a village large, and crowded to excess with natives of all castes, colours, and provinces of India, very many from the extreme W. and N.W., Rajpootana, the Madras Presidency, and Central India. Numbers had come in good cars, well attended, and appeared men of wealth and consequence; while the quantities of conveyances of all sorts standing about rather reminded me of an election, than of anything I had seen in India.

The natives of the place were a more Negro-looking race than the Bengalees to whom I had previously been accustomed; and the curiosity and astonishment they displayed at seeing (probably many of them for the first time) a party of Englishmen, were sufficiently amusing. Our coolies with provisions not having come up, and it being two o'clock in the afternoon, I having had no breakfast, and being ignorant of the exclusively Jain population of the village, sent my servant to the bazaar, for some fowls and eggs; but he was mobbed for asking for these articles, and parched rice, beaten flat, with some coarse sugar, was all I could obtain; together with sweetmeats so odiously flavoured with various herbs, and sullied with such impurities, that we quickly made them over to the elephants.

Not being able to ascend the mountain and return in one day, Mr. Williams and his party went back to the road, leaving Mr. Haddon and myself, who took up our quarters under a tamarind-tree.

In the evening a very gaudy poojah was performed. The car, filled with idols, was covered with gilding and silk, and drawn by noble bulls, festooned and garlanded. A procession was formed in front; and it opened into an avenue, up and down which gaily dressed dancing-boys paced or danced, shaking castanets, the attendant worshippers singing in discordant voices, beating tom-toms, cymbals, &c. Images (of Boodh apparently) abounded on the car, in front of which a child was placed. The throng of natives was very great and perfectly orderly, indeed, sufficiently apathetic: they were remarkably civil in explaining what they understood of their own worship.

At 2 P.M., the thermometer was only 65°, though the day was fine, a strong haze obstructing the sun's rays; at 6 P.M., 58°; at

9 P.M., 56°, and the grass cooled to 49°. Still there was no dew, though the night was starlight.

Having provided doolies, or little bamboo chairs slung on four men's shoulders, in which I put my papers and boxes, we next morning commenced the ascent; at first through woods of the common trees, with large clumps of bamboo, over slaty rocks of gneiss, much inclined and sloping away from the mountain. The view from a ridge 500 feet high was superb, of the village, and its white domes half buried in the forest below, the latter of which continued in sight for many miles to the northward. Descending to a valley some ferns were met with, and a more luxuriant vegetation, especially of *Urticeæ*. Wild bananas formed a beautiful, and to me novel feature in the woods.

The conical hills of the white ants were very abundant. The structure appears to me not an independent one, but the débris of clumps of bamboos, or of the trunks of large trees, which these insects have destroyed. As they work up a tree from the ground, they coat the bark with particles of sand glued together, carrying up this artificial sheath or covered way as they ascend. A clump of bamboos is thus speedily killed; when the dead stems fall away, leaving the mass of stumps coated with sand, which the action of the weather soon fashions into a cone of earthy matter.

Ascending again, the path strikes up the hill, through a thick forest of Sal (*Vateria robusta*) and other trees, spanned with cables of scandent *Bauhinia* stems. At about 3,000 feet above the sea, the vegetation becomes more luxuriant, and by a little stream I collected five species of ferns and some mosses—all in a dry state, however. Still higher, *Clematis*, *Thalictrum*, and an increased number of grasses are seen; with bushes of *Verbenaceæ* and *Compositæ*. The white ant apparently does not enter this cooler region. At 3,500 feet the vegetation again changes, the trees all become gnarled and scattered; and as the dampness also increases, more mosses and ferns appear. We emerged from the forest at the foot of the great ridge of rocky peaks, stretching E. and W. three or four miles. Abundance of a species of berberry and an *Osbeckia* marked the change in the vegetation most decidedly, and were frequent over the whole summit, with coarse grasses, and various bushes.

At noon we reached the saddle of the crest (alt. 4,230 feet), where was a small temple, one of five or six which occupy various prominences of the ridge. The wind, N.W., was cold, the temp. 56°. The view was beautiful, but the atmosphere too hazy: to

the north were ranges of low wooded hills, and the course of the Barakah and Adji rivers; to the south lay a flatter country, with lower ranges, and the Damooda river, its all but waterless bed snowy-white from the exposed granite blocks with which its course is strewn. East and west the several sharp ridges of the mountain itself are seen; the western considerably the highest. Immediately below, the mountain flanks appear clothed with impenetrable forest, here and there interrupted by rocky eminences, while to the north the grand trunk road shoots across the plains, like a white thread, as straight as an arrow, spanning here and there the beds of the mountain torrents.

On the south side the vegetation was more luxuriant than on the north, though, from the heat of the sun, the reverse might have been expected. This is owing partly to the curve taken by the ridge being open to the south, and partly to the winds from that quarter being the moist ones. Accordingly, trees which I had left 3,000 feet below in the north ascent, here ascended to near the summit, such as figs and bananas. A short-stemmed palm (*Phœnix*) was tolerably abundant, and a small tree (*Pterospermum*) on which a species of grass grew epiphytically; forming a curious feature in the landscape.

The situation of the principal temple is very fine, below the saddle in a hollow facing the south, surrounded by jungles of plantain and banyan. It is small, and contains little worthy of notice but the sculptured feet of Paras-nath, and some marble Boodh idols; cross-legged figures with crisp hair and the Brahminical cord. These, a leper covered with ashes in the vestibule, and an officiating priest, were all we saw. Pilgrims were seen on various parts of the mountain in very considerable numbers, passing from one temple to another, and generally leaving a few grains of dry rice at each; the rich and lame were carried in chairs, the poorer walked.

The culminant rocks are very dry, but in the rains may possess many curious plants; a fine *Kalanchoe* was common, with the berberry, a beautiful *Indigofera*, and various other shrubs; a *Bolbophyllum* grew on the rocks, with a small *Begonia*, and some ferns. There were no birds, and very few insects, a beautiful small *Pontia* being the only butterfly. The striped squirrel was very busy amongst the rocks; and I saw a few mice, and the traces of bears.

At 3 P.M., the temperature was 54°, and the air deliciously cool and pleasant. I tried to reach the western peak (perhaps 300 feet above the saddle), by keeping along the ridge, but was cut off by

precipices, and ere I could retrace my steps it was time to descend. This I was glad to do in a doolie, and I was carried to the bottom, with only one short rest, in an hour and three-quarters. The descent was very steep the whole way, partly down steps of sharp rock, where one of the men cut his foot severely. The pathway at the bottom was lined for nearly a quarter of a mile with sick, halt, maimed, lame, and blind beggars, awaiting our descent. It was truly a fearful sight, especially the lepers, and numerous unhappy victims to elephantiasis.

Though the botany of Paras-nath proved interesting, its elevation was not accompanied by such a change from the flora of its base as I had expected. This is no doubt due to its dry climate and sterile soil; characters which it shares with the extensive elevated area of which it forms a part, and upon which I could not detect above 300 species of plants during my journey. Yet, that the atmosphere at the summit is more damp as well as cooler than at the base, is proved as well by the observations as by the vegetation;[1] and in some respects, as the increased proportion of ferns, additional epiphytal orchideous plants, *Begonias*, and other species showed, its top supported a more tropical flora than its base.

[1] Of plants eminently typical of a moister atmosphere, I may mention the genera *Bolbophyllum*, *Begonia*, *Æginetia*, *Disporum*, *Roxburghia*, *Panax*, *Eugenia*, *Myrsine*, *Shorea*, *Millettia*, ferns, mosses, and foliaceous lichens; which appeared in strange association with such dry-climate genera as *Kalanchoe*, *Pterospermum*, and the dwarf-palm, *Phœnix*. Add to this list the *Berberis asiatica*, *Clematis nutans*, *Thalictrum glyphocarpum*, 27 grasses, *Cardamine*, &c., and the mountain top presents a mixture of the plants of a damp hot, a dry hot, and of a temperate climate, in fairly balanced proportions. The prime elements of a tropical flora were however wholly wanting on Paras-nath, where are neither Peppers, *Pothos*, *Arum*, tall or climbing palms, tree-ferns, *Guttiferæ*, vines, or laurels.

CHAPTER II.

Doomree—Vegetation of table-land—Lieutenant Beadle—Birds—Hot springs of Soorujkoond—Plants near them—Shells in them—Cholera-tree—Olibanum—Palms, form of—Dunwah Pass—Trees, native and planted—Wild peacock—Poppy-fields—Geography and geology of Behar and Central India—Toddy-palm—Ground, temperature of—Barroon—Temperature of plants—Lizard—Cross the Soane—Sand, ripple-marks on—Kymore hills—Ground, temperature of—Limestone—Rotas fort and palace—Nitrate of lime—Change of climate—Lime stalagmites, enclosing leaves—Fall of Soane—Spiders, &c.—Scenery and natural history of upper Soane valley—*Hardwickia binata*—Bhel fruit—Dust-storm—Alligator—Catechu—*Cochlospermum*—Leaf-bellows—Scorpions—Tortoises—Florican—Limestone spheres—Coles—Tiger-hunt—Robbery.

In the evening we returned to our tamarind-tree, and the next morning regained the trunk road, following it to the dawk bungalow of Doomree. On the way I found the *Cæsalpinia paniculata*, a magnificent climber, festooning the trees with its dark glossy foliage and gorgeous racemes of orange blossoms. Receding from the mountain, the country again became barren: at Doomree the hills were of crystalline rocks, chiefly quartz and gneiss; no palms or large trees of any kind appeared. The spear-grass abounded, and a detestable nuisance it was, its long awns and husked seed working through trousers and stockings.

Balanites was not uncommon, forming a low thorny bush, with *Ægle marmelos* and *Feronia elephantum*. Having rested the tired elephant, we pushed on in the evening to the next stage, Baghoda, arriving there at 3 A.M., and after a few hours' rest I walked to the bungalow of Lieutenant Beadle, the surveyor of roads, sixteen miles further.

The country around Baghoda is still very barren, but improves considerably in going westward, the ground becoming hilly, and the road winding through prettily wooded valleys, and rising gradually to 1,446 feet. *Nauclea cordifolia*, a tree resembling a young sycamore, is very common; with the Semul (*Bombax*), a very striking tree from its buttressed trunk and gaudy scarlet flowers, swarming with birds, which feed from its honeyed blossoms.

At 10 A.M. the sun became uncomfortably hot, the thermometer being 77°, and the black-bulb thermometer 137°. I had lost my hat, and possessed no substitute but a silken nightcap; so I had to tie a handkerchief over my head, to the astonishment of the

passers-by. Holding my head down, I had little source of amusement but reading the foot-marks on the road; and these were strangely diversified to an English eye. Those of the elephant, camel, buffalo and bullock, horse, ass, pony, dog, goat, sheep and kid, lizard, wild-cat and pigeon, with men, women, and children's feet, naked and shod, were all recognisable.

It was noon ere I arrived at Lieutenant Beadle's, at Belcuppe (alt. 1,219 feet), glad enough of the hearty welcome I received, being very hot, dusty, and hungry. The country about his bungalow is very pretty, from the number of wooded hills and large trees, especially of banyan and peepul, noble oak-like Mahowa (*Bassia*), *Nauclea*, Mango, and *Ficus infectoria*. These are all scattered, however, and do not form forest, such as in a stunted form clothes the hills, consisting of *Diospyros*, *Terminalia*, *Gmelina*, *Nauclea parvifolia*, *Buchanania*, &c. The rocks are still hornblende-schist and granite, with a covering of alluvium, full of quartz pebbles. Insects and birds are numerous, the latter consisting of jays, crows, doves, sparrows, and maina (*Pastor*); also the *Phœnicophaus tristis* ("Mahoka" of the natives), with a note like that of the English cuckoo, as heard late in the season.

I remained two days with Lieutenant Beadle, enjoying in his society several excursions to the hot springs, &c. These springs (called Soorujkoond) are situated close to the road, near the mouth of a valley, in a remarkably pretty spot. They are, of course, objects of worship; and a ruined temple stands close behind them, with three very conspicuous trees—a peepul, a banyan, and a white, thick-stemmed, leafless *Sterculia*, whose branches bore dense clusters of greenish fœtid flowers. The hot springs are four in number, and rise in as many ruined brick tanks about two yards across. Another tank, fed by a cold spring, about twice that size, flows between two of the hot, only two or three paces distant from one of the latter on either hand. All burst through the gneiss rocks, meet in one stream after a few yards, and are conducted by bricked canals to a pool of cold water, about eighty yards off.

The temperatures of the hot springs were respectively 169°, 170°, 173°, and 190°; of the cold, 84° at 4 P.M., and 75° at 7 A.M. the following morning. The hottest is the middle of the five. The water of the cold spring is sweet but not good, and emits gaseous bubbles; it was covered with a green floating *Conferva*. Of the four hot springs, the most copious is about three feet deep, bubbles constantly, boils eggs, and though

brilliantly clear, has an exceedingly nauseous taste. This and the other warm ones cover the bricks and surrounding rocks with a thick incrustation of salts.

Confervæ abound in the warm stream from the springs, and two species, one ochreous brown, and the other green, occur on the margins of the tanks themselves, and in the hottest water; the brown is the best Salamander, and forms a belt in deeper water than the green; both appear in broad luxuriant strata, wherever the temp. is cooled down to 168°, and as low as 90°. Of flowering plants, three showed in an eminent degree a constitution capable of resisting the heat, if not a predilection for it; these were all *Cyperaceæ*, a *Cyperus* and an *Eleocharis*, having their roots in water of 100°, and where they are probably exposed to greater heat, and a *Fimbristylis* at 98°; all were very luxuriant. From the edges of the four hot springs I gathered sixteen species of flowering plants, and from the cold tank five, which did not grow in the hot. A water-beetle, *Coylmbetes* (?) and *Notonecta*, abounded in water at 112°, with quantities of dead molluscs; frogs were very lively, with live molluscs, at 90°, and with various other water-beetles. Having no means of detecting the salts of this water, I bottled some for future analysis.

On the following day I botanised in the neighbourhood, with but poor success. An oblique-leaved fig climbs the other trees, and generally strangles them: two epiphytal *Orchideæ* also occur on the latter, *Vanda Roxburghii* and an *Oberonia*. Dodders (*Cuscuta*) of two species, and *Cassytha*, swarm over and conceal the bushes with their yellow thread-like stems.

I left Belcuppe on the 8th of February, following Mr. Williams' camp. The morning was clear and cold, the temperature only 56°. We crossed the nearly dry broad bed of the Burkutta river, a noble stream during the rains, carrying along huge boulders of granite and gneiss. Near this I passed the Cholera-tree, a famous peepul by the roadside, so called from a detachment of infantry having been attacked and decimated at the spot by that fell disease; it is covered with inscriptions and votive tokens in the shape of rags, &c. We continued to ascend to 1,360 feet, where I came upon a small forest of the Indian Olibanum (*Boswellia thurifera*), conspicuous from its pale bark, and spreading curved branches, leafy at their tips; its general appearance is a good deal like that of the mountain ash. The gum, celebrated throughout the East, was flowing abundantly from the trunk, very fragrant and transparent. The ground was dry, sterile, and rocky; kunker, the curious formation mentioned

at p. 8, appears in the alluvium, which I had not elsewhere seen at this elevation.

Descending to the village of Durshoot, we lost sight of the *Boswellia*, and came upon a magnificent tope of mango, banyan, and peepul, so far superior to anything hitherto met with, that we were glad to choose such a pleasant halting-place for breakfast. There are a few lofty fan-palms here too, great rarities in this soil and elevation: one, about eighty feet high, towered above some wretched hovels, displaying the curious proportions of this tribe of palms: first, a short cone, tapering to one-third the height of the stem, the trunk then swelling to two-thirds, and again tapering to the crown. Beyond this, the country again ascends to Burree (alt. 1,169 feet), another dawk bungalow, a barren place, which we left on the following morning.

So little was there to observe, that I again amused myself by watching footsteps, the precision of which in the sandy soil was curious. Looking down from the elephant, I was interested by seeing them all in *relief*, instead of *depressed*, the slanting rays of the sun in front producing this kind of mirage. Before us rose no more of those wooded hills that had been our companions for the last 120 miles, the absence of which was a sign of the nearly approaching termination of the great hilly plateau we had been traversing for that distance.

Chorparun, at the top of the Dunwah pass, is situated on an extended barren flat, 1,320 feet above the sea, and from it the descent from the table-land to the level of the Soane valley, a little above that of the Ganges at Patna, is very sudden. The road is carried zigzag down a rugged hill of gneiss, with a descent of nearly 1,000 feet in six miles, of which 600 are exceedingly steep. The pass is well wooded, with abundance of bamboo, *Bombax*, *Cassia*, *Acacia*, and *Butea*, with *Calotropis*, the purple Mudar, a very handsome roadside plant, which I had not seen before, but which, with the *Argemone Mexicana*, was to be a companion for hundreds of miles farther. All the views in the pass are very picturesque, though wanting in good foliage, such as *Ficus* would afford, of which I did not see one tree. Indeed the rarity of the genus (except *F. infectoria*) in the native woods of these hills, is very remarkable. The banyan and peepul always appear to be planted, as do the tamarind and mango.

Dunwah, at the foot of the pass, is 620 feet above the sea, and nearly 1,000 below the mean level of the highland I had been traversing. Everything bears here a better aspect; the woods

at the foot of the hills afforded many plants; the bamboo (*B. stricta*) is green instead of yellow and white; a little castor-oil is cultivated, and the Indian date (low and stunted) appears about the cottages.

In the woods I heard and saw the wild peacock for the first time. Its voice is not to be distinguished from that of the tame bird in England, a curious instance of the perpetuation of character under widely different circumstances, for the crow of the wild jungle-fowl does not rival that of the farmyard cock.

In the evening we left Dunwah for Barah (alt. 480 feet), passing over very barren soil, covered with low jungle, the original woods having apparently been cut for fuel. Our elephant, a timid animal, came on a drove of camels in the dark by the roadside, and in his alarm insisted on doing battle, tearing through the thorny jungle, regardless of the mahout, and still more of me: the uproar raised by the camel-drivers was ridiculous, and the danger to my barometer imminent.

We proceeded on the 11th of February to Sheergotty, where Mr. Williams and his camp were awaiting our arrival. Wherever cultivation appeared the crops were tolerably luxuriant, but a great deal of the country yielded scarcely half-a-dozen kinds of plants to any ten square yards of ground. The most prevalent were *Carissa carandas*, *Olax scandens*, two *Zizyphi*, and the ever-present *Acacia Catechu*. The climate is, however, warmer and much moister, for I here observed dew to be formed, which I afterwards found to be usual on the low grounds. Its presence is due to the increased amount of vapour in the atmosphere, the amount of radiation, as shown by the cooling of the earth and vegetation, being the same in the elevated plain and lower levels.

The good soil was very richly cultivated with poppy (which I had not seen before), sugar-cane, wheat, barley, mustard, rape, and flax. At a distance a field of poppies looks like a green lake, studded with white water-lilies. The houses, too, are better, and have tiled roofs; while, in such situations, the road is lined with trees.

A retrospect of the ground passed over is unsatisfactory, as far as botany is concerned, except as showing how potent are the effects of a dry soil and climate during one season of the year upon a vegetation which has no desert types. During the rains probably many more species would be obtained, for of annuals I scarcely found twenty. At that season, however, the jungles of

Behar and Birbhoom, though far from tropically luxuriant, are singularly unhealthy.

In a geographical point of view the range of hills between Burdwan and the Soane is interesting, as being the north-east continuation of a chain which crosses the broadest part of the peninsula of India, from the Gulf of Cambay to the junction of the Ganges and Hoogly at Rajmahal. This range runs south of the Soane and Kymore, which it meets I believe at Omerkuntuk;[1] the granite of this and the sandstone of the other, being there both overlaid with trap. Further west again, the ranges separate, the southern still betraying a nucleus of granite, forming the Satpur range, which divides the valley of the Taptee from that of the Nerbudda. The Paras-nath range is, though the most difficult of definition, the longer of the two parallel ranges; the Vindhya continued as the Kymore, terminating abruptly at the Fort of Chunar on the Ganges. The general and geological features of the two, especially along their eastern course, are very different. This consists of metamorphic gneiss, in various highly inclined beds, through which granite hills protrude, the loftiest of which is Paras-nath. The north-east Vindhya (called Kymore), on the other hand, consists of nearly horizontal beds of sandstone, overlying inclined beds of non-fossiliferous limestone. Between the latter and the Paras-nath gneiss, come (in order of superposition) shivered and undulating strata of metamorphic quartz, hornstone, hornstone-porphyry, jaspers, &c. These are thrown up, by greenstone I believe, along the north and north-west boundary of the gneiss range, and are to be recognised as forming the rocks of Colgong, of Sultangunj, and of Monghyr, on the Ganges, as also various detached hills near Gyah, and along the upper course of the Soane. From these are derived the beautiful agates and cornelians, so famous under the name of Soane pebbles, and they are equally common on the Curruckpore range, as on the south bank of the Soane, so much so in the former position as to have been used in the decoration of the walls of the now ruined palaces near Bhagulpore.

In the route I had taken I had crossed the eastern extremity alone of the range, commencing with a very gradual ascent, over the alluvial plains of the west bank of the Hoogly, then over laterite, succeeded by sandstone of the Indian coal era, which is succeeded by the granite table-land, properly so called. A little beyond the coal-fields, the table-land reaches an average height of 1,130 feet, which is continued for upwards of 100 miles, to the

[1] A lofty mountain said to be 7,000—8,000 feet high.

Dunwah pass. Here the descent is sudden to plains, which, continuous with those of the Ganges, run up the Soane till beyond Rotasghur. Except for the occasional ridges of metamorphic rocks mentioned above, and some hills of intruded greenstone, the lower plain is stoneless, its subjacent rocks being covered with a thicker stratum of the same alluvium which is thinly spread over the higher table-land above. This range is of great interest from its being the source of many important rivers,[1] and of all those which water the country between the Soane, Hoogly, and Ganges, as well as from its deflecting the course of the latter river, which washes its base at Rajmahal, and forcing it to take a sinuous course to the sea. In its climate and botany it differs equally from the Gangetic plains to the north, and from the hot, damp, and exuberant forests of Orissa to the south. Nor are its geological features less different, or its concomitant and in part resultant characters of agriculture and native population. Still further west, the great rivers of the peninsula have their origin, the Nerbudda and Taptee flowing west to the gulf of Cambay, the Cane to the Jumna, the Soane to the Ganges, and the northern feeders of the Godavery to the Bay of Bengal.

On the 12th of February we left Sheergotty (alt. 463 feet), crossing some small streams, which, like all else seen since leaving the Dunwah Pass, flow N. to the Ganges. Between Sheergotty and the Soane occur many of the isolated hills of greenstone mentioned above, better known to the traveller from having been telegraphic stations. Some are much impregnated with iron, and whether for their colour, the curious outlines of many, or their position, form quaint, and in some cases picturesque features in the otherwise tame landscape.

The road being highly cultivated, and the Date-palm becoming more abundant, we encamped in a grove of these trees. All were curiously distorted; the trunks growing zigzag, from the practice of yearly tapping the alternate sides for toddy. The incision is just below the crown, and slopes upwards and inwards: a vessel is hung below the wound, and the juice conducted into it by a little piece of bamboo. This operation spoils the fruit, which, though eaten, is small, and much inferior to the African date.

[1] The chief rivers from this, the great water-shed of Western Bengal, flow north-west and south-east; a few comparatively insignificant streams running north to the Ganges. Amongst the former are the Rheru, the Kunner, and the Coyle, which contribute to the Soane; amongst the latter, the Damooda, Adji, and Barakah, flow into the Hoogly, and the Subunrika, Brahminee, and Mahanuddee into the Bay of Bengal.

CROSSING THE SOANE, WITH THE KYMORE HILLS IN THE DISTANCE.

At Mudunpore (alt. 440 feet) a thermometer, sunk 3 feet 4 inches in the soil, maintained a constant temperature of 71½°, that of the air varying from 77½°, at 3 P.M., to 62 at daylight the following morning; when we moved on to Nourunga (alt. 340 feet), where I bored to 3 feet 8 inches with a heavy iron jumper through an alluvium of such excessive tenacity, that eight natives were employed for four hours in the operation. In both this and another hole, 4 feet 8 inches, the temperature was 72° at 10 P.M.; and on the following morning 71½° in the deepest hole, and 70° in the shallower: that of the external air varied from 71° at 3 P.M., to 57° at daylight on the following morning. At the latter time I took the temperature of the earth near the surface, which showed,

Surface	53°	4 inches	62°
1 inch	57	7 ,,	64
2 ,,	58		

The following day we marched to Barroon (alt. 345 feet) on the alluvial banks of the Soane, crossing a deep stream by a pretty suspension bridge, of which the piers were visible two miles off, so level is the road. The Soane is here three miles wide, its nearly dry bed being a desert of sand, resembling a vast arm of the sea when the tide is out: the banks are very barren, with no trees near, and but very few in the distance. The houses were scarcely visible on the opposite side, behind which the Kymore mountains rise. The Soane is a classical river, being now satisfactorily identified with the Eranoboas of the ancients.[1]

The alluvium is here cut into a cliff, ten or twelve feet above the bed of the river, and against it the sand is blown in naked *dunes*. At 2 P.M., the surface-sand was heated to 110° where sheltered from the wind, and 104° in the open bed of the river. To compare the rapidity and depth to which the heat is communicated by pure sand, and by the tough alluvium, I took the temperature at some inches depth in both. That the alluvium absorbs the heat better, and retains it longer, would appear from the following, the only observations I could make, owing to the tenacity of the soil.

2 P.M. Surface	104°	5 A.M. Surface	51°
2½ inches	93	28 inches	68 5½
5 ,,	88 Sand at this depth, 78°.		

[1] The etymology of Eranoboas is undoubtedly *Hierrinia Vahu* (Sanskrit), the golden-armed. Sona is also the Sanskrit for *gold*. The stream is celebrated for its agates (Soane pebbles), which are common, but gold is not now obtained from it.

Finding the fresh milky juice of *Calotropis* to be only 72°, I was curious to ascertain at what depth this temperature was to be obtained in the sand of the river-bed, where the plant grew.

Surface . . .	104½°		3½ inches .	85°	Compact.
1 inch . . .	102		8 „ .	73	Wet.
2 „ . . .	94		15 „ .	72	Ditto.
2½ „ . . .	90				

The power this plant exercises of maintaining a low temperature of 72°, though the main portion which is subterraneous is surrounded by a soiled heat to between 90° and 104°, is very remarkable, and no doubt proximately due to the rapidity of evaporation from the foliage, and consequent activity in the circulation. Its exposed leaves maintained a temperature of 80°, nearly 25° cooler than the similarly exposed sand and alluvium. On the same night the leaves were cooled down to 54°, when the sand had cooled to 51°. Before daylight the following morning the sand had cooled to 43°, and the leaves of the *Calotropis* to 45½°. I omitted to observe the temperature of the sap at the latter time; but the sand at the same depth (15 inches) as that at which its temperature and that of the plant agreed at mid-day was 68°. And assuming this to be the heat of the plant, we find that the leaves are heated by solar radiation during the day 8°, and cooled by nocturnal radiation 22½°.

Mr. Theobald (my companion in this and many other rambles) pulled a lizard from a hole in the bank. Its throat was mottled with scales of brown and yellow. Three ticks had fastened on it, each of a size covering three or four scales: the first was yellow, corresponding with the yellow colour of the animal's belly, where it lodged; the second brown, from the lizard's head; but the third, which was clinging to the parti-coloured scales of the neck, had its body parti-coloured, the hues corresponding with the individual scales which they covered. The adaptation of the two first specimens in colour to the parts to which they adhered is sufficiently remarkable; but the third case was most extraordinary.

During the night of the 14th of February I observed a beautiful display, apparently of the Aurora borealis, an account of which will be found in the Appendix.

February 15.—Our passage through the Soane sands was very tedious, though accomplished in excellent style, the elephants pushing forward the heavy waggons of mining tools with their foreheads. The wheels were sometimes buried to the axles in

sand, and the draught bullocks were rather in the way than otherwise.

The body of water over which we ferried was not above 80 yards wide. In the rains, when the whole space of three miles is one rapid flood, 10 or 12 feet deep, charged with yellow sand, this river must present an imposing spectacle. I walked across the dry portion, observing the sand-waves, all ranged in one direction, perpendicular to that of the prevailing wind, accurately representing the undulations of the ocean, as seen from a mast-head or high cliff. As the sand was finer or coarser, so did the surface resemble a gentle ripple, or an ocean-swell. The progressive motion of the waves was curious, and caused by the lighter particles being blown over the ridges and filling up the hollows to leeward. There were a few islets in the sand, a kind of oases of mud and clay, in laminæ no thicker than paper, and these were at once denizened by various weeds. Some large spots were green with wheat and barley-crops, both suffering from smut.

We encamped close to the western shore, at the village of Dearee (alt. 330 feet); it marks the termination of the Kymore Hills, along whose S.E. bases our course now lay, as we here quitted the grand trunk road for a rarely visited country.

On the 16th we marched south up the river to Tilotho (alt. 395 feet), through a rich and highly-cultivated country, covered with indigo, cotton, sugar-cane, safflower, castor-oil, poppy, and various grains. Dodders (*Cuscuta*) covered even tall trees with a golden web, and the *Capparis acuminata* was in full flower along the road side. Tilotho, a beautiful village, is situated in a superb grove of Mango, Banyan, Peepul, Tamarind, and *Bassia*. The Date, or toddy-palm, and fan-palm are very abundant and tall: each had a pot hung under the crown. The natives climb these trunks with a hoop or cord round the body and both ankles, and a bottle-gourd or other vessel hanging round the neck to receive the juice from the stock-bottle, in this aerial wine-cellar. These palms were so lofty that the climbers, as they paused in their ascent to gaze with wonder at our large retinue, resembled monkeys rather than men. Both trees yield a toddy, but in this district they stated that that from the *Phœnix* (Date) alone ferments, and is distilled; while in other parts of India the *Borassus* (fan-palm) is chiefly employed. I walked to the hills, over a level cultivated country interspersed with occasional belts of low wood; in which the pensile nests of the weaver-bird were abundant, but generally hanging out of reach, in prickly *Acacias*.

The hills here present a straight precipitous wall of horizontally

stratified sandstone, very like the rocks at the Cape of Good Hope, with occasionally a shallow valley, and a slope of débris at the base, densely clothed with dry jungle. The cliffs are about 1000 feet high, and the plants similar to those at the foot of Parasnath, but stunted: I climbed to the top, the latter part by steps or ledges of sandstone. The summit was clothed with long grass, trees of *Diospyros* and *Terminalia*, and here and there the *Boswellia*. On the precipitous rocks the curious white-barked *Sterculia fœtida* "flung its arms abroad," leafless, and looking as if blasted by lightning.

A hole was sunk here again for the thermometers, and, as usual, with great labour; the temperatures obtained were—

	Air.	4 feet 6 inches, under good shade of trees.
9 P.M.	64½°	77°
11 P.M.	.	76°
5½ A.M.	58½°	76°

This is a very great rise (of 4°) above any of those previously obtained, and certainly indicates a much higher mean temperature of the locality. I can only suppose it due to the radiation of heat from the long range of sandstone cliff, exposed to the south, which overlooks the flat whereon we were encamped, and which, though four or five miles off, forms a very important feature. The differences of temperature in the shade taken on this and the other side of the river are 2¾° higher on this side.

On the 17th we marched to Akbarpore (alt. 400 feet), a village overhung by the rocky precipice of Rotasghur, a spur of the Kymore, standing abruptly forward.

The range, in proceeding up the Soane valley, gradually approaches the river, and beds of non-fossiliferous limestone are seen protruding below the sandstone and occasionally rising into rounded hills, the paths upon which appear as white as do those through the chalk districts of England. The overlying beds of sandstone are nearly horizontal, or with a dip to the N.W.; the subjacent ones of limestone dip at a greater angle. Passing between the river and a detached conical hill of limestone, capped with a flat mass of sandstone, the spur of Rotas broke suddenly on the view, and very grand it was, quite realising my anticipations of the position of these eyrie-like hill-forts of India. To the left of the spur winds the valley of the Soane, with low-wooded hills on its opposite bank, and a higher range, connected with that of Behar, in the distance. To the right, the hills sweep round, forming an immense and beautifully wooded amphitheatre,

about four miles deep, bounded with a continuation of the escarpment. At the foot of the crowned spur is the village of Akbarpore, where we encamped in a Mango tope;[1] it occupies some pretty undulating limestone hills, amongst which several streams flow from the amphitheatre to the Soane.

During our two days' stay here, I had the advantage of the society of Mr. C. E. Davis, who was our guide during some rambles in the neighbourhood, and to whose experience, founded on the best habits of observation, I am indebted for much information. At noon we started to ascend to the palace, on the top of the spur. On the way we passed a beautiful well, sixty feet deep, and with a fine flight of steps to the bottom. Now neglected and overgrown with flowering weeds and creepers, it afforded me many of the plants I had only previously obtained in a withered state; it was curious to observe there some of the species of the hill-tops, whose seeds doubtless are scattered abundantly over the surrounding plains, and only vegetate where they find a coolness and moisture resembling that of the altitude they elsewhere affect. A fine fig-tree growing out of the stone-work spread its leafy green branches over the well mouth, which was about twelve feet square; its roots assumed a singular form, enveloping two sides of the wall with a beautiful net-work, which, at *high-water mark* (rainy season), abruptly divides into thousands of little brushes, dipping into the water which they fringe. It was a pretty cool place to descend to, from a temperature of 80° above, to 74° at the bottom, where the water was 60°; and most refreshing to look, either up the shaft to the green fig shadowing the deep profound, or along the sloping steps through a vista of flowering herbs and climbing plants, to the blue heaven of a burning sky.

The ascent to Rotas is over the dry hills of limestone, covered with a scrubby brushwood, to a crest where are the first rude and ruined defences. The limestone is succeeded by the sandstone cliff cut into steps, which led from ledge to ledge and gap to gap, well guarded with walls and an archway of solid masonry. Through this we passed on to the flat summit of the Kymore hills, covered with grass and forest, intersected by paths in all directions. The ascent is about 1,200 feet—a long pull in the blazing sun of February. The turf consists chiefly of spear-grass and *Andropogon muricatus*, the kus-kus, which yields a favourite fragrant oil, used as a medicine in India. The trees are of the

[1] On the 24th of June, 1848, the Soane rose to an unprecedented height, and laid this grove of Mangos three feet under water.

kinds mentioned before. A pretty octagonal summer-house, with its roof supported by pillars, occupies one of the highest points of the plateau, and commands a superb view of the scenery before described. From this a walk of three miles leads through the woods to the palace. The buildings are very extensive, and though now ruinous, bear evidence of great beauty in the architecture: light galleries, supported by slender columns, long cool arcades, screened squares and terraced walks, are the principal features. The rooms open out upon flat roofs, commanding views of the long endless table-land to the west, and a sheer precipice of 1,000 feet on the other side, with the Soane, the amphitheatre of hills, and the village of Akbarpore below.

This and Beejaghur, higher up the Soane, were amongst the most recently reduced forts, and this was further the last of those wrested from Baber in 1542. Some of the rooms are still habitable, but the greater part are ruinous, and covered with climbers, both of wild flowers and of the naturalized garden plants of the adjoining shrubbery; the *Arbor-tristis*, with *Hibiscus*, *Abutilon*, &c., and above all, the little yellow-flowered *Linaria ramosissima*, crawling over every ruined wall, as we see the walls of our old English castles clothed with its congener of *L. Cymbalaria*.

In the old dark stables I observed the soil to be covered with a copious efflorescence of nitrate of lime, like soap-suds scattered about.

I made Rotas Palace 1,490 feet above the sea, so that this table-land is here only fifty feet higher than that I had crossed on the grand trunk road, before descending at the Dunwah pass. Its mean temperature is of course considerably (4°) below that of the valley, but though so cool, ague prevail after the rains. The extremes of temperature are less marked than in the valley, which becomes excessively heated, and where hot winds sometimes last for a week, blowing in furious gusts.

The climate of the whole neighbourhood has of late changed materially; and the fall of rain has much diminished, consequent on felling the forests; even within six years the hail-storms have been far less frequent and violent. The air on the hills is highly electrical, owing, no doubt, to the dryness of the atmosphere, and to this the frequent recurrence of hail-storms may be due.

The zoology of these regions is tolerably copious, but little is known of the natural history of a great part of the plateau; a native tribe, prone to human sacrifices, is talked of. Tigers are common, and bears are numerous; they have, besides, the leopard,

panther, viverine cat, and civet; and of the dog tribe the pariah, jackal fox, and wild dog, called Koa. Deer are very numerous, of six or seven kinds. A small alligator inhabits the hill streams, said to be a very different animal from either of the Soane species.

During our descent we examined several instances of ripple-mark (fossil waves' footsteps) in the sandstone; they resembled the fluting of the *Sigillaria* stems, in the coal-measures, and occurring as they did here, in sandstone, a little above great beds of limestone, had been taken for such, and as indications of coal.

On the following day we visited Rajghat, a steep ghat or pass leading up the cliff to Rotas Palace, a little higher up the river. We took the elephants to the mouth of the glen, where we dismounted, and whence we followed a stream abounding in small fish and aquatic insects (*Dytisci* and *Gyrini*), through a close jungle, to the foot of the cliffs, where there are indications of coal. The woods were full of monkeys, and amongst other plants I observed *Murraya exotica*, but it was scarce. Though the jungle was so dense, the woods were very dry, containing no Palm, *Aroideæ*, Peppers, *Orchideæ* or Ferns. Here, at the foot of the red cliffs, which towered imposingly above, as seen through the tree tops, are several small seams of coaly matter in the sandstone, with abundance of pyrites, sulphur, and copious efflorescences of salts of iron; but no coal. The springs from the cliffs above are charged with lime, of which enormous tuff beds are deposited on the sandstone, full of impressions of the leaves and stems of the surrounding trees, which, however, I found it very difficult to recognise, and could not help contrasting this circumstance with the fact that geologists, unskilled in botany, see no difficulty in referring equally imperfect remains of extinct vegetables to existing genera. In some parts of their course the stream take up quantities of the efflorescence, which they scatter over the sandstones in a singular manner.

At Akbarpore I had sunk two thermometers, one 4 feet 6 inches, the other 5 feet 6 inches; both invariably indicated 76°, the air varying from 56° to 79½°. Dew had formed every night since leaving Dunwah, the grass being here cooled 12° below the air.

On the 19th of February we marched up the Soane to Tura, passing some low hills of limestone, between the cliffs of the Kymore and the river. On the shaded river-banks grew abundance of English genera—*Cynoglossum*, *Veronica*, *Potentilla*, *Ranunculus sceleratus*, *Rumex*, several herbaceous *Compositæ* and

Labiatæ; Tamarix formed a small bush in rocky hillocks in the bed of the river, and in pools were several aquatic plants, *Zannichellia*, *Chara*, a pretty little *Vallisneria*, and *Potamogeton*. The Brahminee goose was common here, and we usually saw in the morning immense flocks of wild geese overhead, migrating northward.

Here I tried again the effect of solar and nocturnal radiation on the sand, at different depths, not being able to do so on the alluvium.

Noon, Temperature of air, 87°.	Daylight of following morning.	Noon.	Daylight.
Surface 110°	52°	4 inches 84°	67°
1 inch 102°	55°	8 ditto 77° Sand wet.	73° Wet
2 ditto 93½°	58°	16 ditto 76° ditto	74°

From Tura our little army again crossed the Soane, the scarped cliffs of the Kymore approaching close to the river on the west side. The bed is very sandy, and about one mile and a half across.

The elephants were employed again, as at Baroon, to push the cart: one of them had a bump in consequence, as large as a child's head, just above the trunk, and bleeding much; but the brave beast disregarded this, when the word of command was given by his driver.

The stream was very narrow, but deep and rapid, obstructed with beds of coarse agate, jasper, cornelian and chalcedony pebbles. A clumsy boat took us across to the village of Soanepore, a wretched collection of hovels. The crops were thin and poor, and I saw no palms or good trees. Squirrels, however, abounded, and were busy laying up their stores; descending from the trees, they scoured across a road to a field of tares, mounted the hedge, took an observation, foraged and returned up the tree with their booty, quickly descended, and repeated the operation of reconnoitering and plundering.

The bed of the river is here considerably above that at Dearee, where the mean of the observations with those of Baroon, made it about 300 feet. The mean of those taken here and on the opposite side, at Tura, gives about 400 feet, indicating a fall of 100 feet in only 40 miles.

Near this the sandy banks of the Soane were full of martins' nests, each one containing a pair of eggs. The deserted ones were literally crammed full of long-legged spiders (*Opilio*), which could be raked out with a stick when they came pouring down

the cliff like corn from a sack; the quantities are quite inconceivable. I did not observe the martin feed on them.

The entomology here resembled that of Europe, more than I had expected in a tropical country, where predaceous beetles, at least *Carabideæ* and *Staphylinideæ*, are generally considered rare. The latter tribes swarmed under the clods, of many species but all small, and so singularly active that I could not give the time to collect many. In the banks again, the round egg-like earthy chrysalis of the *Sphynx Atropos* (?) and the many-celled nidus of the leaf-cutter bee, were very common.

A large columnar *Euphorbia* (*E. ligulata*) is common all along the Soane, and I observed it to be used everywhere for fencing. I had not remarked the *E. neriifolia;* and the *E. tereticaulis* had been very rarely seen since leaving Calcutta. The *Cactus* is nowhere found; it is abundant in many parts of Bengal, but certainly not indigenous.

From this place onwards up to the Soane, there was no road of any kind, and we were compelled to be our own road engineers. The sameness of the vegetation and lateness of the season made me regret this the less, for I was disappointed in my anticipations of finding luxuriance and novelty in these wilds. Before us the valley narrowed considerably, the forest became denser, the country on the south side was broken with rounded hills, and on the north the noble cliffs of the Kymore dipped down to the river. The villages were smaller, more scattered and poverty-stricken, with the Mahowa and Mango as the usual trees; the banyan, peepul, and tamarind being rare. The natives are of an aboriginal jungle race; and are tall, athletic, erect, much less indolent and more spirited than the listless natives of the plains.

February 21.—Started at daylight: but so slow and difficult was our progress through fields and woods, and across deep gorges from the hills, that we only advanced five miles in the day; the elephant's head too was aching too badly to let him push, and the camel would not proceed when the draught was not equal. What was worse, it was impossible to get the oxen to pull together up the inclined planes we cut, except by placing a man at the head of each of the six, eight, or ten in a team, and simultaneously screwing round their tails; when one tortured animal sometimes capsizes the vehicle. The small carts got on better, though it was most nervous to see them rushing down the steeps, especially those with our fragile instruments, &c.

Kosdera, where we halted, is a pretty place, elevated 440 feet, with a broad stream from the hills flowing past it. These hills

are of limestone, and rounded, resting upon others of hornstone and jasper. Following up the stream I came to some rapids, where the stream is crossed by large beds of hornstone and porphyry rocks, excessively hard, and pitched up at right angles, or with a bold dip to the north. The number of strata was very great, and only a few inches or even lines thick: they presented all varieties of jasper, hornstone, and quartz of numerous colours, with occasional seams of porphyry or breccia. The rocks were elegantly fringed with a fern I had not hitherto seen, *Polypodium proliferum*, which is the only species the Soane valley presents at this season.

Returning over the hills, I found *Hardwickia binata*, a most elegant leguminous tree, tall, erect, with an elongated coma, and the branches pendulous. These trees grew in a shallow bed of alluvium, enclosing abundance of agate pebbles and kunker, the former derived from the quartzy strata above noticed.

On the 23rd and 24th we continued to follow up the Soane, first to Panchadurma (alt. 490 feet), and thence to Pepura (alt. 587 feet), the country becoming densely wooded, very wild, and picturesque, the woods being full of monkeys, parrots, peacocks, hornbills, and wild animals. *Strychnos potatorum*, whose berries are used to purify water, forms a dense foliaged tree, thirty to sixty feet high, some individuals pale yellow, others deep green, both in apparent health. *Feronia Elephantum* and *Ægle marmelos* [1] were very abundant, with *Sterculia*, and the dwarf date-palm.

One of my carts was here hopelessly broken down; advancing on the spokes instead of the tire of the wheels. By the banks of a deep gully here the rocks are well exposed: they consist of soft clay shales resting on the limestone, which is nearly horizontal; and this again, unconformably on the quartz and hornstone rocks, which are confused, and tilted up at all angles.

A spur of the Kymore, like that of Rotas, here projects to the bed of the river, and was blazing at night with the beacon-like fires of the natives, lighted to scare the tigers and bears from the spots where they cut wood and bamboo; they afforded a splendid spectacle, the flames in some places leaping zig-zag from hill to hill in front of us, and looking as if a gigantic letter W were written in fire.

The night was bright and clear, with much lightning, the latter attracted to the spur, and darting down as it were to mingle its fire with that of the forest; so many flashes appeared to strike

[1] The Bhel fruit, lately introduced into English medical practice, as an astringent of great effect, in cases of diarrhœa and dysentery.

on the flames, that it is probable the heated air in their neighbourhood attracted them. We were awakened between 3 and 4 A.M., by a violent dust-storm, which threatened to carry away the tents. Our position at the mouth of the gulley formed by the opposite hills, no doubt accounted for it. The gusts were so furious that it was impossible to observe the barometer, which I returned to its case on ascertaining that any indications of a rise or fall in the column must have been quite trifling. The night had been oppressively hot, with many insects flying about; amongst which I noticed earwigs, a genus erroneously supposed rarely to take to the wing in Britain.

At 8½ A.M. it suddenly fell calm, and we proceeded to Chanchee (alt. 500 feet), the native carts breaking down in their passage over the projecting beds of flinty rocks, or as they hurried down the inclined planes we cut through the precipitous clay banks of the streams. Near Chanchee we passed an alligator, just killed by two men, a foul beast, about nine feet long, of the mugger kind. More absorbing than its natural history was the circumstance of its having swallowed a child, that was playing in the water as its mother was washing her utensils. The brute was hardly dead, much distended by the prey, and the mother was standing beside it. A very touching group was this: the parent with her hands clasped in agony, unable to withdraw her eyes from the cursed reptile, which still clung to life with that tenacity for which its tribe are so conspicuous; beside these the two athletes leaned on the bloody bamboo staffs, with which they had all but despatched the animal.

This poor woman earned a scanty maintenance by making catechu: inhabiting a little cottage, and having no property but two cattle to bring wood from the hills, and a very few household chattels; and how few of these they only know who have seen the meagre furniture of Danga hovels. Her husband cut the trees in the forest and dragged them to the hut, but at this time he was sick, and her only boy, her future stay, it was, whom the beast had devoured.

This province is famous for the quantity of catechu its dry forests yield. The plant (*Acacia*) is a little thorny tree, erect, and bearing a rounded head of well remembered prickly branches. Its wood is yellow, with a dark brick-red heart, most profitable in January and useless in June (for yielding the extract).

The *Butea frondosa* was abundantly in flower here, and a gorgeous sight. In mass the inflorescence resembles sheets of flame, and individually the flowers are eminently beautiful, the

bright orange-red petals contrasting brillantly against the jet-black velvety calyx. The nest of the *Megachile* (leaf-cutter bee) was in thousands in the cliffs, with Mayflies, Caddis-worms, spiders, and many predaceous beetles. Lamellicorn bettles were very rare, even *Aphodius*, and of *Cetoniæ* I did not see one.

We marched on the 28th to Kota, at the junction of the river of that name with the Soane, over hills of flinty rock, which projected everywhere, to the utter ruin of the elephants' feet, and then over undulating hills of limestone; on the latter I found trees of *Cochlospermum*, whose curious thick branches spread out somewhat awkwardly, each tipped with a cluster of golden yellow flowers, as large as the palm of the hand, and very beautiful: it is a tropical Gum-Cistus in the appearance and texture of the petals, and their frail nature. The bark abounds in a transparent gum, of which the white ants seem fond, for they had killed many trees. Of the leaves the curious rude leaf-bellows are made, with which the natives of these hills smelt iron. Scorpions appeared very common here, of a small kind, 1½ inches long; several were captured, and one of our party was stung on the finger; the smart was burning for an hour or two, and then ceased.

At Kota we were nearly opposite the cliffs at Beejaghur, where coal is reported to exist; and here we again crossed the Soane, and for the last time. The ford is three miles up the river, and we marched to it through deep sand. The bed of the river is here 500 feet above the sea, and about three-quarters of a mile broad, the rapid stream being 50 or 60 yards wide, and breast deep. The sand is firm and siliceous, with no mica; nodules of coal are said to be washed down thus far from the coal-beds of Burdee, a good deal higher up, but we saw none.

The cliffs come close to the river on the opposite side, their bases clothed with woods which teemed with birds. The soil is richer, and individual trees, especially of *Bombax*, *Terminalia*, and *Mahowa*, very fine; one tree of the *Hardwickia*, about 120 feet high, was as handsome a monarch of the forest as I ever saw, and it is not often that one sees trees in the tropics, which for a combination of beauty in outline, harmony of colour, and arrangement of branches and foliage, would form so striking an addition to an English park. There is a large break in the Kymore hills here, beyond the village of Kunch, through which our route lay to Beejaghur, and the Ganges at Mirzapore; the cliffs leaving the river and trending to the north in a continuous escarpment flanked with low ranges of rounded hills, and termi-

nating in an abrupt spur (Mungeesa Peak) whose summit was covered with a ragged forest. At Kunch we saw four alligators sleeping in the river, looking at a distance like logs of wood, all of the short-nosed or mugger kind, dreaded by man and beast; I saw none of the sharp-snouted (or garial), so common on the Ganges, where their long bills, with a garniture of teeth and prominent eyes peeping out of the water, remind one of geological lectures and visions of *Ichthyosauri*. Tortoises were frequent in the river, basking on the rocks, and popping into the water when approached.

On the 1st of March we left the Soane, and struck inland over a rough hilly country, covered with forest, fully 1,000 feet below the top of the Kymore table-land, which here recedes from the river and surrounds an undulating plain, some ten miles either way, facing the south. The roads, or rather pathways, were very bad, and quite impassable for the carts without much engineering, cutting through forest, smoothing down the banks of the watercourses to be crossed, and clearing away the rocks as we best might. We traversed the empty bed of a mountain torrent, with perpendicular banks of alluvium 30 feet high, and then plunged into a dense forest. Our course was directed towards Mungeesa Peak, the remarkable projecting spur, between which and a conical hill the path led. Whether on the elephants or on foot, the thorny jujubes, *Acacias*, &c. were most troublesome, and all our previous scratchings were nothing to this. Peacocks and jungle-fowl were very frequent, the squabbling of the former and the hooting of the monkeys constantly grating on the ear. There were innumerable pigeons and a few Floricans (a kind of bustard—considered the best-eating game-bird in India). From the defile we emerged on an open flat, halting at Sulkun, a scattered village (alt. 684 feet), peopled by a bold-looking race (Coles)[1] who habitually carry the spear and shield. We had here the pleasure of meeting Mr. Felle, an English gentleman employed in the Revenue department; this being one of the roads along which the natives transport their salt, sugar, &c., from one province to another.

In the afternoon, I examined the conical hill, which, like that near Rotas, is of stratified beds of limestone, capped with sandstone. A stream runs round its base, cutting through the

[1] The Coles, like the Danghas of the Rajmahal and Behar hills, and the natives of the mountains of the peninsula, form one of the aboriginal tribes of British India, and are widely different people from either the Hindoos or Mussulmen.

alluvium to the subjacent rock, which is exposed, and contains flattened spheres of limestone. These spheres are from the size of a fist to a child's head, or even much larger; they are excessively hard, and neither laminated nor formed of concentric layers. At the top of the hill the sandstone cap was perpendicular on all sides, and its dry top covered with small trees, especially of *Cochlospermum.* A few larger trees of *Fici* cling to the edge of the rocks, and by forcing their roots into the interstices detached enormous masses, affording good dens for bears and other wild animals. From the top, the view of rock, river, forest, and plain, was very fine, the eye ranging over a broad flat, girt by precipitous hills;—West, the Kymore or Vindhya range rose again in rugged elevations;—South, flowed the Soane, backed by ranges of wooded hills, smoking like volcanoes with the fires of the natives;—below, lay the bed of the stream we had left at the foot of the hills, cutting its way through the alluvium, and following a deep gorge to the Soane, which was there hidden by the rugged heights we had crossed, on which the greater part of our camp might be seen still straggling onwards;—east, and close above us, the bold spur of Mungeesa shot up, terminating a continuous stretch of red precipices, clothed with forest along their bases, and over their horizontal tops.

From Sulkun the view of the famed fort and palace of Beejaghur is very singular, planted on the summit of an isolated hill of sandstone, about ten miles off. A large tree by the palace marks its site; for, at this distance, the buildings are themselves undistinguishable.

There are many tigers on these hills; and as one was close by, and had killed several cattle, Mr. Felle kindly offered us a chance of slaying him. Bullocks are tethered out, over-night, in the places likely to be visited by the brute; he kills one of them, and is from the spot tracked to his haunt by natives, who visit the stations early in the morning, and report the whereabouts of his lair. The sportsman then goes to the attack mounted on an elephant, or having a *roost* fixed in a tree, on the trail of the tiger, and he employs some hundred natives to drive the animal past the lurking-place.

On the present occasion, the locale of the tiger was doubtful; but it was thought that by beating over several miles of country he (or at any rate, some other game) might be driven past a certain spot. Thither, accordingly, the natives were sent, who built machans (stages) in the trees, high out of danger's reach; Mr. Theobald and myself occupied one of these perches in a

Hardwickia tree, and Mr. Felle another, close by, both on the slope of a steep hill, surrounded by jungly valleys. We were also well thatched in with leafy boughs, to prevent the wary beast from espying the ambush, and had a whole stand of arms ready for his reception.

When roosted aloft, and duly charged to keep profound silence (which I obeyed to the letter, by falling sound asleep) the word was passed to the beaters, who surrounded our post on the plain-side, extending some miles in line, and full two or three distant from us. They entered the jungle, beating tom-toms, singing and shouting as they advanced, and converging towards our position. In the noonday solitude of these vast forests, our situation was romantic enough: there was not a breath of wind, an insect or bird stirring; and the wild cries of the men, and the hollow sound of the drums broke upon the ear from a great distance, gradually swelling and falling, as the natives ascended the heights or crossed the valleys. After about an hour and a half, the beaters emerged from the jungle under our retreat; one by one, two by two, but preceded by no single living thing, either mouse, bird, deer, or bear, and much less tiger. The beaters received about a penny a-piece for the day's work; a rich guerdon for these poor wretches, whom necessity sometimes drives to feed on rats and offal.

We were detained three days at Sulkun, from inability to get on with the carts; and as the pass over the Kymore to the north (on the way to Mirzapore) was to be still worse, I took advantage of Mr. Felle's kind offer of camels and elephants to make the best of my way forward, accompanying that gentleman, *en route*, to his residence at Shahgunj, on the table-land.

Both the climate and natural history of this flat on which Sulkun stands, are similar to those of the banks of the Soane; the crops are wretched. At this season the dryness of the atmosphere is excessive; our nails cracked, and skins peeled, whilst all articles of wood, tortoisehell, &c., broke on the slightest blow. The air, too, was always highly electrical, and the dew-point was frequently 40° below the temperature of the air.

The natives are far from honest; they robbed one of the tents placed between two others, wherein a light was burning. One gentleman in it was awake, and on turning saw five men at his bedside, who escaped with a bag of booty, in the shape of clothes, and a tempting strong, brass-bound box, containing private letters. The clothes they dropped outside, but the box

of letters was carried off. There were about a hundred people asleep outside the tents, between whose many fires the rogues must have passed, eluding also the guard, who were, or ought to have been, awake.

CHAPTER III.

Ek-powa Ghat—Sandstones—Shahgunj—Table-land, elevation, &c.—Gum-arabic—Mango—Fair—Aquatic plants—Rujubbund—Storm—False sunset and sunrise—Bind hills—Mirzapore—Manufactures, imports, &c.—Climate of—Thuggee—Chunar—Benares—Mosque—Observatory—Sarnath—Ghazeepore—Rose-gardens—Manufactory of Attar—Lord Cornwallis' tomb—Ganges, scenery and natural history of—Pelicans—Vegetation—Insects—Dinapore—Patna—Opium godowns and manufacture—Mudar, white and purple—Monghyr islets—Hot Springs of Setakoond—Alluvium of Ganges—Rocks of Sultun-gunj—Bhaugulpore—Temples of Mt. Manden—Coles and native tribes—Bhaugulpore rangers—Horticultural gardens.

On the 3rd of March I bade farewell to Mr. Williams and his kind party, and rode over a plain to the village of Markunda, at the foot of the Ghat. There the country becomes very rocky and woody, and a stream is crossed, which runs over a flat bed of limestone, cracked into the appearance of a tesselated pavement. For many miles there is no pass over the Kymore range, except this, significantly called "Ek-powa-Ghat" (one-foot Ghat). It is evidently a *fault*, or shifting of the rocks, producing so broken a cliff as to admit of a path winding over the shattered crags. On either side, the precipices are extremely steep, of horizontally stratified rocks, continued in an unbroken line, and the views across the plain and Soane valley, over which the sun was now setting, were superb. At the summit we entered on a dead flat plain or table-land, with no hills, except along the brim of the broad valley we had left, where are some curious broad pyramids, formed of slabs of sandstone arranged in steps. By dark we reached the village of Roump (alt. 1,090 feet), beyond the top of the pass.

On the next day I proceeded on a small, fast, and wofully high-trotting elephant, to Shahgunj, where I enjoyed Mr. Felle's hospitality for a few days. The country here, though elevated, is, from the nature of the soil and formation, much more fertile than what I had left. Water is abundant, both in tanks and

wells, and rice-fields, broad and productive, cover the ground; while groves of tamarinds and mangos, now loaded with blossoms, occur at every village.

It is very singular that the elevation of this table-land (1,100 feet at Shahgunj) should coincide with that of the granite range of Upper Bengal, where crossed by the grand trunk road, though they have no feature but the presence of alluvium in common. Scarce a hillock varies the surface here, and the agricultural produce of the two is widely different. Here the flat ledges of sandstone retain the moisture, and give rise to none of those impetuous torrents which sweep it off the inclined beds of gneiss, or splintered quartz. Nor is there here any of the effloresced salts so forbidding to vegetation where they occur. Wherever the alluvium is deep on these hills, neither *Catechu*, *Olibanum*, *Butea*, *Terminalia*, *Diospyros*, dwarf-palm, or any of those plants are to be met with, which abound wherever the rock is superficial, and irrespectively of its mineral characters.

The gum-arabic *Acacia* is abundant here, though not seen below, and very rare to the eastward of this meridian, for I saw but little of it in Behar. It is a plant partial to a dry climate, and rather prefers a good soil. In its distribution it is some degrees follows the range of the camel, which in its constant companion over thousands of leagues. In the valley of the Ganges I was told that neither the animal nor plant flourished east of the Soane, where I experienced a marked change in the humidity of the atmosphere on my passage down the Ganges. It was a circumstance I was interested in, having first met with the camel at Teneriffe and the Cape Verd Islands, the western-most limit of its distribution; imported thither, however, as it now is into Australia, where, though there is no *Acacia Arabica*, four hundred other species of the genus are known.

The mango, which is certainly *the* fruit of India (as the pine-apple is of the Eastern Islands, and the orange of the West), was now blossoming, and a superb sight. The young leaves are purplish-green, and forms a curious contrast to the deep lurid hue of the older foliage; especially when the tree is (which often occurs) dimidiate, one half the green, and the other the red shades of colours; when in full blossom, all forms a mass of yellow, diffusing a fragrance rather too strong and peculiar to be pleasant.

We passed a village where a large fair was being held, and singularly familiar its arrangements were to my early associations. The women and children are the prime customers; for the latter

whirl-you-go-rounds, toys, and sweetmeats were destined; to tempt the former, little booths of gay ornaments, patches for the forehead, ear-rings of quaint shapes, bugles, and beads. Here, as at home, I remarked that the vendors of these superfluities occupy the approaches to this Vanity-Fair. As, throughout the East, the trades are congregated into particular quarters of the cities, so here the itinerants grouped themselves into little bazaars for each class of commodity. Whilst I was engaged in purchasing a few articles of native workmanship, my elephant made an attack on a sweetmeat stall, demolishing a magnificent erection of barley-sugar before his proceedings could be put a stop to.

Mr. Felle's bungalow (whose garden smiled with roses in this wilderness) was surrounded by a moat (fed by a spring), which was full of aquatic plants, *Nymphæa*, *Damasonium*, *Villarsia cristata*, *Aponogeton*, three species of *Potamogeton*, two of *Naias*, *Chara* and *Zannichellia* (the two latter indifferently, and often together, used in the refinement of sugar). In a large tank hard by, wholly fed by rain water, I observed only the *Villarsia Indica*, no *Aponogeton*, *Nymphæa*, or *Damasonium*, nor did these occur in any of the other tanks I examined, which were otherwise well peopled with plants. This may not be owing to the quality of the water so much as to its varying quantity in the tank.

All around here, as at Roump, is a dead flat, except towards the crest of the ghats which overhang the valley of the Soane, and there the sandstone rock rises by steps into low hills. During a ride to a natural tank amongst these rocky elevations, I passed from the alluvium to the sandstone, and at once met with all the prevailing plants of the granite, gneiss, limestone and hornstone rocks previously examined, and which I have enumerated too often to require recapitulation; a convincing proof that the mechanical properties and not the chemical constitution of the rocks regulate the distribution of these plants.

Rujubbund (the pleasant spot) is a small tarn, or more properly the expanded bed of a stream, art having aided nature in its formation: it is edged by rocks and cliffs fringed with the usual trees of the neighbourhood; it is a wild and pretty spot, not unlike some birch-bordered pool in the mountains of Wales or Scotland, sequestered and picturesque. It was dark before I got back, with heavy clouds and vivid lightning approaching from the south-west. The day had been very hot (3 P.M., 90°), and the evening the same; but the barometer did not foretell the coming tempest, which broke with fury at 7 P.M., blowing open the doors,

and accompanied with vivid lightning and heavy thunder, close by and all round, though no rain fell.

In the clear dry mornings of these regions, a curious optical phenomena may be observed, of a *sunrise* in the *west*, and *sunset* in the *east*. In either case, bright and well-defined beams rise to the zenith, often crossing to the opposite horizon. It is a beautiful feature in the firmament, and equally visible whether the horizon be cloudy or clear, the white beams being projected indifferently against a dark vapour or the blue serene. The zodiacal light shines from an hour or two after sunset till midnight, with singular brightness, almost equalling the milky way.

March 7.—Left Shahgunj for Mirzapore, following the road to Goorawal, over a dead alluvial flat without a feature to remark. Turning north from that village, the country undulates, exposing the rocky nucleus, and presenting the usual concomitant vegetation. Occasionally park-like views occurred, which, where diversified by the rocky valleys, resemble much the noble scenery of the Forest of Dean on the borders of Wales; the *Mahowa* especially representing the oak, with its spreading and often gnarled branches. Many of the exposed slabs of sandstone are beautifully waved on the surface with the *ripple-mark* impression.

Amowee, where I arrived at 9 P.M., is on an open grassy flat, about fifteen miles from the Ganges, which is seen from the neighbourhood, flowing among trees, with the white houses, domes, and temples of Mirzapore scattered around, and high above which the dust-clouds were coursing along the horizon.

Mr. Money, the magistrate of Mirzapore, kindly sent a mounted messenger to meet me here, who had vast trouble in getting bearers for my palkee. In it I proceeded the next day to Mirzapore, descending a steep ghat of the Bind hills by an excellent road, to the level plains of the Ganges. Unlike the Dunwah pass, this is wholly barren. At the foot the sun was intensely hot, the roads alternately rocky and dusty, the villages thronged with a widely different looking race from those of the hills, and the whole air of the outskirts, on a sultry afternoon, far from agreeable.

Mirzapore is a straggling town, said to contain 100,000 inhabitants. It flanks the river, and is built on an undulating alluvial bank, full of kunker, elevated 360 feet above the sea, and from 50 to 80 above the present level of the river. The vicinity of the Ganges and its green bank, and the numbers of fine trees around, render it a pleasing, though not a fine town. It presents

the usual Asiatic contrast of squalor and gaudiness; consisting of large squares and broad streets, interspersed with acres of low huts and groves of trees. It is celebrated for its manufactory of carpets, which are admirable in appearance, and, save in durability, equal to the English. Indigo seed from Bundelkund is also a most extensive article of commerce, the best coming from the Doab. For cotton, lac, sugar, and saltpetre, it is one of the greatest marts in India. The articles of native manufacture are brass washing and cooking utensils, and stone deities worked out of the sandstone.

There is little native vegetation, the country being covered with cultivation and extensive groves of mango, and occasionally of guava. English vegetables are abundant and excellent, and the strawberries, which ripen in March, rival the European fruit in size, but hardly in flavour.

During the few days spent at Mirzapore with my kind friend, Mr. C. Hamilton, I was surprised to find the temperature of the day cooler by nearly 4° than that of the hills above, or of the upper part of the Soane valley; while on the other hand the nights were decidedly warmer. The dew-point again was even lower in proportion (7½°), and the climate consequently drier. The atmosphere was extremely dry and electrical, the hair constantly crackling when combed. Further west, where the climate becomes still drier, the electricity of the air is even greater. Mr. Griffith mentions in his journal that in filling barometer tubes in Affghanistan, he constantly experienced a shock.

Here I had the pleasure of meeting Lieutenant Ward, one of the suppressors of Thuggee (*Thuggee*, in Hindostan, signifies a deceiver; fraud, not open force, being employed). This gentleman kindly showed me the approvers or king's evidence of his establishment, belonging to these three classes of human scourges, Thug, Dakoit, and Poisoner. Of these the first was the Thug, a mild-looking man, who had been born and bred to the profession: he had commited many murders, saw no harm in them, and felt neither shame nor remorse. His organs of observation and destructiveness were large, and the cerebellum small. He explained to me how the gang waylay the unwary traveller, enter into conversation with him, and have him suddenly seized, when the superior throws his own linen girdle round the victim's neck and strangles him, pressing the knuckles against the spine. Taking off his own, he passed it round my arm, and showed me the turn as coolly as a sailor once taught me the *hangman's knot*. The Thug is of any caste, and from any part of India. The profes-

sion have particular stations, which they generally select for murder, throwing the body of their victim into a well.

The Dakoit (*dakhee*, a robber) belongs to a class who rob in gangs, but never commit murder—arson and housebreaking also forming part of their profession. These are all high-class Rajpoots, originally from Guzerat; who, on being conquered, vowed vengeance on mankind. They speak both Hindostanee and the otherwise extinct Guzerat language; this is guttural in the extreme, and very singular in sound. They are a very remarkable people, found throughout India, and called by various names; their women dress peculiarly, and are utterly devoid of modesty. The man I examined was a short, square, but far from powerful, Nepalese, with high arched eyebrows, and no organs of observation. These people are great cowards.

The Poisoners all belong to one caste, of Pasie, or dealers in toddy: they go singly or in gangs, haunting the travellers' resting-places, where they drop half a rupee weight of pounded or whole *Datura* seeds into his food, producing a twenty-hours' intoxication, during which he is robbed, and left to recover or sink under the stupifying effects of the narcotic. He told me that the *Datura* seed is gathered without ceremony, and at any time, place, or age of the plant. He was a dirty, ill-conditioned looking fellow, with no bumps behind his ears, or prominence of eyebrow region, but a remarkable cerebellum.

Though now all but extinct (except in Cuttack), through ten or fifteen years of unceasing vigilance on the part of Government, and incredible activity and acuteness in the officers employed, the Thugs were formerly a wonderfully numerous body, who abstained from their vocation solely in the immediate neighbourhood of their own villages; which, however, were not exempt from the visits of other Thugs; so that, as Major Sleeman says,—"The annually returning tide of murder swept unsparingly over the whole face of India, from the Sutlej to the sea-coast, and from the Himalaya to Cape Comorin. One narrow district alone was free, the Concan, beyond the ghats, whither they never penetrated." In Bengal, river Thugs replace the travelling practitioner. Candeish and Rohilkund alone harboured no Thugs as residents, but they were nevertheless haunted by the gangs.

Their origin is uncertain, but supposed to be very ancient, soon after the Mohammedan conquest. They now claim a divine original, and are supposed to have supernatural powers, and to be the emissaries of the divinity, like the wolf, the tiger, and the bear. It is only lately that they have swarmed so

prodigiously—seven original gangs having migrated from Delhi to the Gangetic provinces about 200 years ago, and from these all the rest have sprung. Many belong to the most amiable, intelligent, and respectable classes of the lower and even middle ranks: they love their profession, regard murder as sport, and are never haunted with dreams, or troubled with pangs of conscience during hours of solitude, or in the last moments of life. The victim is an acceptable sacrifice to the goddess Davee, who by some classes is supposed to eat the lifeless body, and thus save her votaries the necessity of concealing it.

They are extremely superstitious, always consulting omens, such as the direction in which a hare or jackal crosses the road; and even far more trivial circumstances will determine the fate of a dozen people, and perhaps of an immense treasure. All worship the pickaxe, which is symbolical of their profession, and an oath sworn on it binds closer than on the Koran. The consecra- of this weapon is a most elababorate ceremony, and takes place only under certain trees. They rise through various grades: the lowest are scouts; the second, sextons; the third are holders of the victims' hands; the highest, stranglers.

Though all agree in never practising cruelty, or robbing previous to murder,—never allowing any but infants to escape (and these are trained to Thuggee), and never leaving a trace of such goods as may be identified,—there are several variations in their mode of conducting operations; some tribes spare certain castes, others none: murder of woman is against all rules; but the practice crept into certain gangs, and this it is which led to their discountenance by the goddess Davee, and the consequent downfall of the system. Davee, they say, allowed the British to punish them, because a certain gang had murdered the mothers to obtain their daughters to be sold to prostitution.

Major Sleeman has constructed a map demonstrating the number of "Bails," or regular stations for committing murder, in the kingdom of Oude alone, which is 170 miles long by 100 broad, and in which are 274, which are regarded by the Thug with as much satisfaction and interest as a game preserve is in England: nor are these "bails" less numerous in other parts of India. Of twenty assassins who were examined, one frankly confessed to having been engaged in 931 murders, and the least guilty of the number to 24. Sometimes 150 persons collected into one gang, and their profits have often been immense, the murder of six persons on one occasion yielding 82,000 rupees; upwards of £8,000.

Of the various facilities for keeping up the system, the most prominent are, the practice amongst the natives of travelling before dawn, of travellers mixing freely together, and taking their meals by the wayside instead of in villages; in the very Bails, in fact, to which they are inveigled by the Thug in the shape of a fellow-traveller; money remittances are also usually made by disguised travellers, whose treasure is exposed at the custom-houses, and, worst of all, the bankers will never own to the losses they sustain, which, as a visitation of God, would, if avenged, lead, they think, to future, and perhaps heavier punishment. Had the Thugs destroyed Englishmen, they would quickly have been put down; but the system being invariably practised on a class of people acknowledging the finger of the Deity in its execution, its glaring enormities were long in rousing the attention of the Indian Goverment.

A few examples of activity exercised by the suppressors may be interesting. They act wholly through the information given by approvers, who are simply king's evidences. Of 600 Thugs engaged in the murder of 64 people, and the plunder of nearly £20,000, all except seventy were captured in ten years, though separated into six gangs, and their operations continued from 1826 to 1830: the last party was taken in 1836. And again, between the years 1826 and 1835, 1562 Thugs were seized, of whom 382 were hanged, and 909 transported; so that now it is but seldom these wretches are ever heard of.

To show the extent of their operations I shall quote an anecdote from Sleeman's Reports (to which I am indebted for most of the above information). He states that he was for three years in charge of a district on the Nerbudda, and considered himself acquainted with every circumstance that occurred in the neighbourhood; yet, during that time, 100 people were murdered and buried within less than a quarter of a mile of his own residence!

Two hundred and fifty boats full of river Thugs, in crews of fifteen, infested the Ganges between Benares and Calcutta, during five months of every year, under pretence of conveying pilgrims. Travellers along the banks were tracked, and offered a passage, which if refused in the first boat was probably accepted in some other. At a given signal the crew rushed in, doubled up the decoyed victim, broke his back, and threw him into the river, where floating corpses are too numerous to elicit even an exclamation.

At Mirzapore I engaged a boat to carry me down the river to Bhagulpore, whence I was to proceed to the Sikkim-Himalaya.

The sketch at p. 61 will give some idea of this vessel, which, though slow and very shabby, had the advantage of being cooler and more commodious than the handsomer craft. Its appearance was not unlike that of a floating haystock, or thatched cottage: its length was forty feet, and breadth fifteen, and it drew a foot and a half of water: the deck, on which a kind of house, neatly framed of matting, was erected, was but a little above the water's edge. My portion of this floating residence was lined with a kind of reed-work formed of long culms of *Saccharum*. The crew and captain consisted of six all but naked Hindoos, one of whom steered by the huge rudder, sitting on a bamboo-stage astern; the others pulled four oars in the very bows opposite my door, or tracked the boats along the river-bank.

In my room (for cabin I cannot call it) stood my palkee, fitted as a bed, with mosquito curtains; a chair and table. On one side were placed all my papers and plants, under arrangement to go home; on the other, my provisions, rice, sugar, curry-powder, a preserved ham, and cheese, &c. Around hung telescope, botanical box, dark lantern, barometer, and thermometer, &c., &c. Our position was often *ashore*, and, Hindoo-like, on the lee-shore, going bump, bump, bump, so that I could hardly write. I considered myself fortunate in having to take this slow conveyance down, it enabling me to write and arrange all day long.

I left on the 15th of March, and in the afternoon of the same day passed Chunar.[1] This is a tabular mass of sandstone, projecting into the river, and the eastern termination of the Kymore range. There is not a rock between this and the Himalaya, and barely a stone all the way down the Ganges, till the granite and gneiss rocks of the Behar range are again met with. The current of the Ganges is here very strong, and its breadth much lessened: the river runs between high banks of alluvium, containing much kunker. At Benares it expands into a broad stream, with a current which during the rains is said to flow eight miles an hour, when the waters rise 43 feet. The fall hence is 300 feet to its junction with the Hooghly, viz., one foot to every mile. My observations made that from Mirzapore to Benares considerably greater.

Benares is the Athens of India. The variety of buildings along the bank is incredible. There are temples of every shape in all stages of completion and dilapidation, and at all angles of inclination; for the banks give way so much that many of these edifices are fearfully out of the perpendicular.

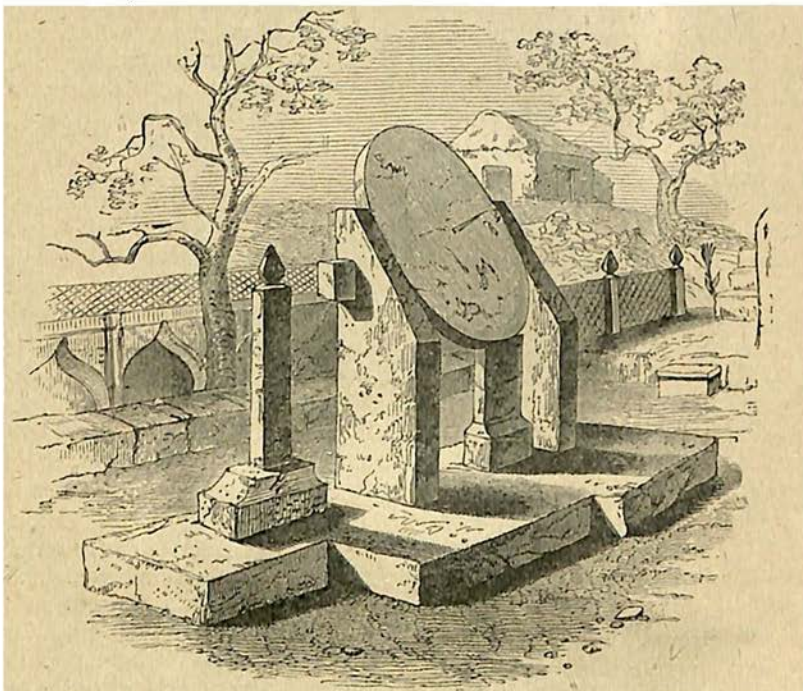
[1] The first station at which Henry Martyn laboured in India.

The famed mosque, built by Aurungzebe on the site of a Hindoo temple, is remarkable for its two octagonal minarets, 232 feet above the Ganges. The view from it over the town, especially of the European Resident's quarter, is fine; but the building itself is deficient in beauty or ornament: it commands the muddy river with its thousands of boats, its waters peopled with swimmers and bathers, who spring in from the many temples, water-terraces, and ghats on the city side: opposite is a great sandy plain. The town below looks a mass of poor, square, flat-roofed houses, of which 12,000 are brick, and 16,000 mud and thatch, through the crowd of which, and of small temples, the eye wanders in vain for some attractive feature or evidence of the wealth, the devotion, the science, or the grandeur of a city celebrated throughout the East for all these attributes. Green parrots and pigeons people the air.

The general appearance of an oriental town is always more or less ruinous; and here the eye is fatigued with bricks and crumbling edifices, and the ear with prayer-bells. The bright meadows and green trees which adorn the European Resident's dwelling, some four miles back from the river, alone relieve the monotony of the scene. The streets are so narrow that it is difficult to ride a horse through them; and the houses are often six stories high, with galleries crossing above from house to house. These tall, gaunt edifices sometimes give place to clumps of cottages, and a mass of dusty ruins, the unsavoury retreats of vermin and filth, where the *Calotropis arborea* generally spreads its white branches and glaucous leaves—a dusty plant. Here, too, enormous spiders' webs hang from the crumbling walls, choked also with dust, and resembling curtains of coarse muslin, being often some yards across, and not arranged in radii and arcs, but spun like weaver's woofs. Paintings, remarkable only for their hideous proportions and want of perspective, are daubed in vermilion, ochre, and indigo. The elephant, camel, and porpoise of the Ganges, dog, shepherd, peacock, and horse, are especially frequent, and so is a running pattern of a hand spread open, with a blood-red spot on the palm. A still less elegant but frequent object is the fuel, which is composed of the manure collected on the roads of the city, moulded into flat cakes, and stuck by the women on the walls to dry, retaining the sign-manual of the artist in the impressed form of her outspread hand. The cognizance of the Rajah, two fish chained together, appears over the gates of public buildings.

The hundreds of temples and shrines throughout the city are

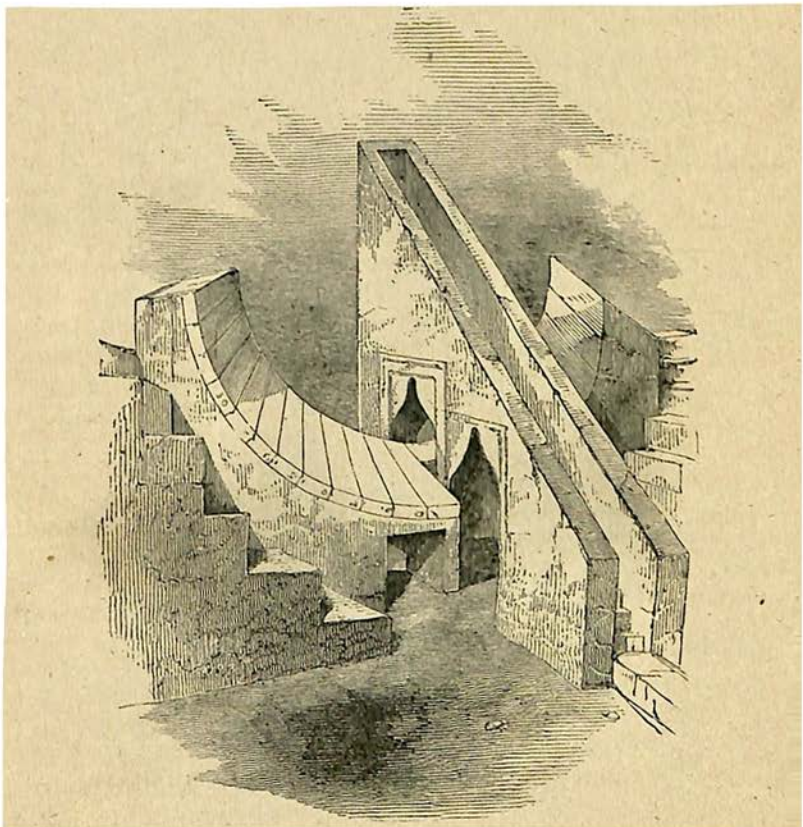
its most remarkable feature: sacred bulls, and lingams of all sizes, strewed with flowers and grains of rice, meet the eye at every turn; and the city's boast is the possession of one million idols, which, of one kind and another, I can well believe. The great Hindoo festival of the *Holi* was now celebrating, and the city more than ordinarily crowded; throwing red powder (lac and flour), with rose-water, is the great diversion at a festival more childish by far than a carnival.



I. EQUATORIAL SUN-DIAL.
(DIAMETER OF FACE OF DIAL, 2 FEET 2 INCHES.)

Through the kindness of Mr. Reade (the Commissioner), I obtained admission to the Bishishar-Kumardil, the "holiest of holies." It was a small, low, stone building, daubed with red inside, and swarming with stone images of Brahminee bulls, and various disgusting emblems. A fat old Brahmin, naked to the waist, took me in, but allowed no followers; and what with my ignorance of his phraseology, the clang of bells and din of voices, I gained but little information. Some fine bells from

Nepal were evidently the lion of the temple. I emerged, adorned with a chaplet of magnolia flowers, and with my hands full of *Calotropis* and *Nyctanthes* blossoms. It was a horrid place for noise, smell, and sights. Thence I went to a holy well, rendered sacred because Siva, when stepping from the Himalaya to Ceylon, accidentally let a medicine chest fall into it. The



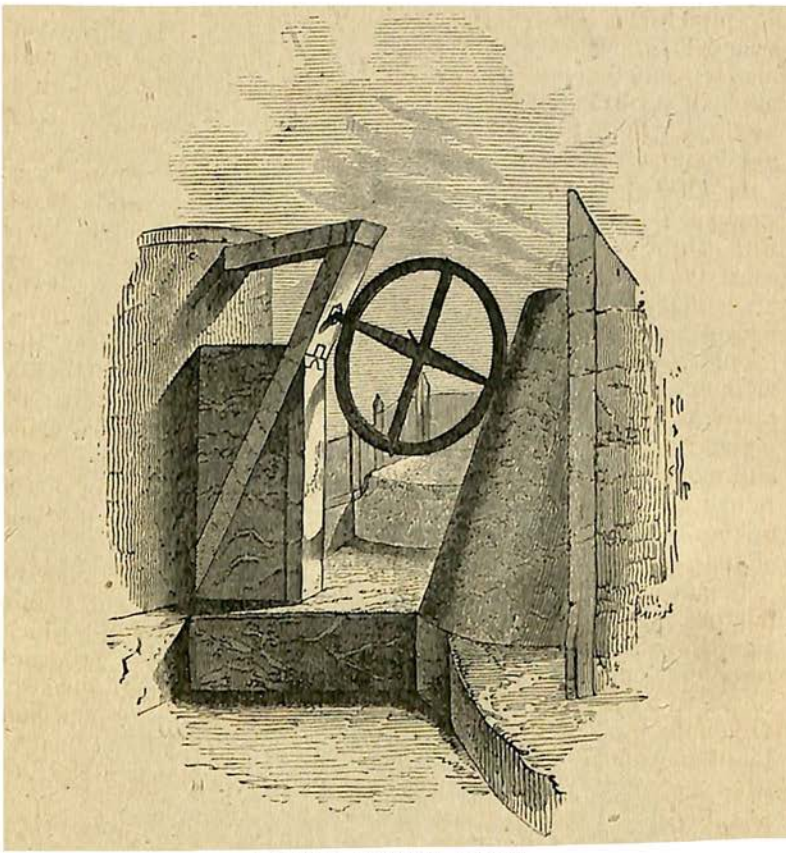
2. EQUINOCTIAL SUN-DIAL.
(LENGTH OF GNOMON, 39 FEET; OF EACH QUADRANT, 9 FEET.)

natives frequent it with little basins or baskets of rice, sugar, &c., dropping in a little of each while they mutter prayers.

The observatory at Benares, and those at Delhi, Matra on the Jumna, and Oujein, were built by Jey-Sing, Rajah of Jayanagar, upwards of 200 years ago; his skill in mathematical science was so well known, that the Emperor Mahommed Shah employed

him to reform the calendar. Mr. Hunter, in the "Asiatic Researches," gives a translation of the lucubrations of this really enlightened man, as contained in the introduction to his own almanac.

Of the more important instruments I took sketches; No. 1, is the Naree-wila, or Equatorial dial; No. 2, the Semrat-yunta, or



3. BRASS AZIMUTH CIRCLE.
(DIAMETER, 2 FEET.)

Equinoctial dial; No. 3, an Equatorial, probably a Kranti-urit, or Azimuth circle.[1] Jey-Sing's genius and love of science seem, according to Hunter, to have descended to some of his family

[1] Hunter, in As. Soc. Researches, 177 (Calcutta); Sir R. Barker in Phil. Trans., lxvii. 608 (1777); J. L. Williams, Phil. Trans., lxxxiii. 45 (1793).

who died early in this century, when "Urania fled before the brazen-fronted Mars, and the best of the observatories, that of Oujein, was turned into an arsenal and cannon foundry."

The observatory is still the most interesting object in Benares, though it is now dirty and ruinous, and the great stone instruments are rapidly crumbling away. The building is square, with a central court and flat roof, round which the astrolabes, &c. are arranged. A half naked Astronomer-Royal, with a large sore on his stomach, took me round—he was a pitiful object, and told me he was very hungry. The observatory is nominally supported by the Rajah of Jeypore, who doles out a too scanty pittance to his scientific corps.

In the afternoon Mr. Reade drove me to the Sar-nath, a singular Boodhist temple, a cylindrical mass of brickwork, faced with stone, the scrolls on which were very beautiful, and as sharp as if freshly cut: it is surmounted by a tall dome, and is altogether about seventy or a hundred feet high. Of the Boodh figures only one remains, the others having been used by a recent magistrate of Benares in repairing a bridge over the Goomtee! From this place the Boodhist monuments, Hindoo temple, Mussulman mosque, and English church, were all embraced in one *coup d'œil*. On our return, we drove past many enormous mounds of earth and brick-work, the vestiges of Old Benares, but whether once continued to the present city or not is unknown. Remains are abundant, eighteen feet below the site of the present city.

Benares is the Mecca of the Hindoos, and the number of pilgrims who visit it is incalculable. Casi (its ancient name, signifying splendid), is alleged to be no part of this world, which rests on eternity, whereas Benares is perched on a prong of Siva's trident, and is hence beyond the reach of earthquakes.[1] Originally built of gold, the sins of the inhabitants were punished by its transmutation into stone, and latterly into mud and thatch: whoever enters it, and especially visits its principal idol (Siva fossilised), is secure of heaven.

On the 18th I left Benares for Ghazepore, a pretty town situated on the north bank of the river, celebrated for its manufacture of rose-water, the tomb of Lord Cornwallis, and a site of the Company's stud. The Rose gardens surround the town: they are fields, with low bushes of the plant grown in rows, red with

[1] Probably an allusion to the infrequency of these phenomena in this meridian: they being common both in Eastern Bengal, and in Western India beyond the Ganges.

blossoms in the morning, all of which are, however, plucked long before midday. The petals are put into clay stills, with twice their weight of water, and the produce exposed to the fresh air, for a night, in open vessels. The unskimmed water affords the best, and it is often twice and even oftener distilled; but the fluid deteriorates by too much distillation. The Attar is skimmed from the exposed pans, and sells at £10 the rupee weight, to make which 20,000 flowers are required. It is frequently adulterated with sandal-wood oil.

Lord Cornwallis' mausoleum is a handsome building, modelled by Flaxman after the Sybil's Temple. The allegorical designs of Hindoos and sorrowing soldiers with reversed arms, which decorate two sides of the enclosed tomb, though perhaps as good as can be, are under any treatment unclassical and uncouth. The simple laurel and oak-leaf chaplets on the alternating faces are far more suitable and suggestive.

March 21.—I left Ghazepore and dropped down the Ganges; the general features of which are soon described. A strong current four or five miles broad, of muddy water, flows between a precipitous bank of alluvium or sand on one side, and a flat shelving one of sand, or more rarely mud, on the other. Sand-banks are frequent in the river, especially where the great affluents débouche; and there generally are formed vast expanses of sand, small "Saharas," studded with stalking pillars of sand, raised seventy or eighty feet high by gusts of wind, erect, stately, grave-looking columns, all shaft, with neither basement nor capital, the genii of the "Arabian Nights." The river is always dotted with boats of all shapes, mine being perhaps of the most common description; the great square, Yankee-like steamers, towing their accommodation-boats (as the passengers' floating hotels are called), are the rarest. Trees are few on the banks, except near villages, and there is hardly a palm to be seen above Patna. Towns are unfrequent, such as there are being mere collections of huts, with the ghat and boats at the bottom of the bank; and at a respectful distance from the bazaar stand the neat bungalows of the European residents, with their smiling gardens, hedgings, and fencings, and loitering servants at the door. A rotting charpoy (or bedstead) on the banks is a common sight,—the "*sola reliquia*" of some poor Hindoo, who departs this life by the side of the stream, to which his body is afterwards committed.

Shoals of small goggled-eyed fish are seen, that spring clear out of the water, and are preyed upon by terns and other birds; a few insects skim the surface; turtle and porpoises tumble along, all

forming a very busy contrast to the lazy alligator, sunning his green scaly back near the shore, with his ichthyosaurian snout raised high above the water. Birds are numerous, especially early and late in the day. Along the silent shore the hungry Pariah dog may be seen tearing his meal from some stranded corpse, whilst the adjutant-bird, with his head sank on his body and one leg tucked up, patiently awaits his turn. At night the beautiful Brahminee geese alight, one by one, and seek total solitude; ever since having disturbed a god in his slumbers, these birds are fated to pass the night in single blessedness. The gulls and terns, again, roost in flocks, as do the wild geese and pelicans,—the latter, however, not till after making a hearty and very noisy supper. These birds congregate by the sides of pools, and beat the water with violence, so as to scare the fish, which thus become an easy prey; a fact which was, I believe, first indicated by Pallas, during his residence on the banks of the Caspian Sea. Shells are scarce, and consist of a few small bivalves; their comparative absence is probably due to the paucity of limestone in the mountains whence the many feeders flow. The sand is pure white and small-grained, with fragments of hornblende and mica, the latter varying in abundance as a feeder is near or far away. Pink sand[1] of garnets is very common, and deposited in layers interstratified with the white quartz sand. Worm-marks, ripple-marks, and the footsteps of alligators, birds and beasts, abound in the wet sand. The vegetation of the banks consists of annuals which find no permanent resting-place. Along the sandy shores the ever-present plants are mostly English, as Dock, a *Nasturtium*, *Ranunculus sceleratus*, *Fumitory*, *Juncus bufonius*, Common Vervain, *Gnaphalium luteo-album*, and very frequently *Veronica Anagallis*. On the alluvium grow the same, mixed with Tamarisk, *Acacia Arabica*, and a few other bushes.

Withered grass abounds; and wheat, dhal (*Cajanus*) and gram (*Cicer arietinum*), *Carthamus*, vetches, and rice are the staple products of the country. Bushes are few, except the universally prevalent Adhatoda and *Calotropis*. Trees, also, are rare, and of stunted growth; Figs, the *Artocarpus* and some *Leguminosæ* prevail most. I saw but two kinds of palm, the fan-palm, and *Phœnix*: the latter is characteristic of the driest locality. Then, for the animal creation, men, women, and children abound, both on the banks, and plying up and down the Ganges. The humped cow

[1] I have seen the same garnet sand covering the bottom of the Himalayan torrents, where it is the produce of disintegrated gneiss, and whence it is transported to the Ganges.

(of which the ox is used for draught) is common. Camels I occasionally observed, and more rarely the elephant; ponies, goats, and dogs muster strong. Porpoises and alligators infest the river, even above Benares. Flies and mosquitos are terrible pests; and so are the odious flying-bugs,[1] which insinuate themselves between one's skin and clothes, diffusing a dreadful odour, which is increased by any attempt to touch or remove them. In the evening it was impossible to keep insects out of the boat, or to hinder their putting the lights out; and of these the most intolerable was the above-mentioned flying-bug. Saucy crickets, too, swarm, and spring at one's face, whilst mosquitos maintain a constant guerilla warfare, trying to the patience no less than to the nerves. Thick webs of the gossamer spider float across the river during the heat of the day, as coarse as fine thread, and being inhaled keep tickling the nose and lips.

On the 18th, the morning commenced with a dust storm, the horizon was about 20 yards off, and ashy white with clouds of sand; the trees were scarcely visible, and everything in my boat was covered with a fine coat of impalpable powder, collected from the boundless alluvial plains through which the Ganges flows. Trees were scarcely discernible, and so dry was the wind that drops of water vanished like magic. Neither ferns, mosses, nor lichens grow along the banks of the Ganges; they cannot survive the transition from parching like this to the three months' floods at midsummer, when the country is for miles under water.

March 23.—Passed the mouth of the Soane, a vast expanse of sand dotted with droves of camels; and soon after, the widespread spits of sand along the north bank announced the mouth of the Gogra, one of the vastest of the many Himalayan affluents of the Ganges.

On the 25th of March I reached Dinapore, a large military station, sufficiently insalubrious, particularly for European troops, the barracks being so misplaced that the inmates are suffocated; the buildings run east and west instead of north and south, and therefore lose all the breeze in the hottest weather. From this place I sent the boat to Patna, and proceeded thither by land to the house of Dr. Irvine, an old acquaintance and botanist, from whom I received a most kind welcome. On the road, Bengal forms of vegetation, to which I had been for three months a stranger, reappeared; likewise groves of fan and toddy palms, which are both very rare higher up the river; clumps of large bamboo, orange, *Acacia Sissoo*, *Melia*, *Guatteria longifolia*, *Spon-*

[1] Large Hemipterous insects, of the genus *Derecteryx*.

dias mangifera, *Odina*, *Euphorbia pentagona*, *neriifolia* and *trigona*, were common roadside plants. In the gardens, Papaw, *Croton*, *Jatropha*, *Buddleia*, *Cookia*, Loquat, Litchi, Longan, all kinds of the orange tribe, and the cocoa-nut, some from their presence, and many from their profusion, indicated a decided change of climate, a receding from the desert north-west of India, and its dry winds, and an approach to the damper regions of the many-mouthed Ganges.

My main object at Patna being to see the opium Godowns (stores), I waited on Dr. Corbett, the Assistant-Agent, who kindly explained everything to me, and to whose obliging attentions I am much indebted.

The E. I. Company grant licences for the cultivation of the poppy, and contract for all the produce at certain rates, varying with the quality. No opium can be grown without this licence, and an advance equal to about two-thirds of the value of the produce is made to the grower. This produce is made over to the district collectors, who approximately fix the worth of the contents of each jar, and forward it to Patna, where rewards are given for the best samples, and the worst are condemned without payment; but all is turned to some account in the reduction of the drug to a state fit for market.

The poppy flowers in the end of January and beginning of February, and the capsules are sliced in February and March with a little sharp instrument like a saw, made of three iron plates with jagged edges, tied together. The cultivation is very carefully conducted, nor are there any very apparent means of improving this branch of commerce and revenue. During the N.W., or dry winds, the best opium is procured, the worst during the moist, or E. and N.E., when the drug imbibes moisture, and a watery bad solution of opium collects in cavities of its substance, and is called Passewa, according to the absence of which the opium is generally prized.

At the end of March the opium jars arrive at the stores by water and by land, and continue accumulating for some weeks. Every jar is stowed in a proper place, and its contents separately tested with extreme accuracy, and valued. When the whole quantity has been received, the contents of all the jars are thrown into great vats, occupying a very large building, whence the mass is distributed, to be made up into balls for the markets. This operation is carried on in a long paved room, where every man is ticketed, and many overseers are stationed to see that the work is properly conducted. Each workman sits on a stool, with a double

stage and a tray before him. On the top stage is a tin basin, containing opium sufficient for three balls; in the lower another basin, holding water: in the tray stands a brass hemispherical cup, in which the ball is worked. To the man's right hand is another tray, with two compartments, one containing thin pancakes of poppy petals pressed together, the other a cupful of sticky opium-water made from refuse opium. The man takes the brass cup, and places a pancake at the bottom, smears it with opium-water, and with many plies of the pancakes makes a coat for the opium. Of this he takes about one-third of the mass before him, puts it inside the pancake, and agglutinates many others over it: the balls are then again weighed, and reduced or increased to a certain weight if necessary. At the day's end, each man takes his work to a rack with numbered compartments, and deposits it in that which answers to his own number; thence the balls (each being put in a clay cup) are carried to an enormous drying-room, where they are exposed in tiers, and constantly examined and turned, to prevent their being attacked by weevils, which are very prevalent during moist winds, little boys creeping along the racks all day long for this purpose. When dry, the balls are packed in two layers of six each in chests, with the stalks, dried leaves, and capsules of the plant, and sent down to Calcutta. A little opium is prepared of very fine quality for the Government Hospitals, and some for general sale in India; but the proportion is trifling, and such is made up into square cakes. A good workman will prepare from thirty to fifty balls a day, the total produce being 10,000 to 12,000 a day; during one working season 1,353,000 balls are manufactured for the Chinese market alone.

The poppy-petal *pancakes*, each about a foot radius, are made in the fields by women, by the simple operation of pressing the fresh petals together. They are brought in large baskets, and purchased at the commencement of the season. The liquor with which the pancakes are agglutinated together by the ball-maker, and worked into the ball, is merely inspissated opium-water, the opium for which is derived from the condemned opium (Passewa), the washing of the utensils, and of the workmen, every one of whom is nightly laved before he leaves the establishment, and the water is inspissated. Thus not a particle of opium is lost. To encourage the farmers, the refuse stalks, leaves, and heads are bought up, to pack the balls with; but this is far from an economical plan, for it is difficult to keep the refuse from damp and insects.

A powerful smell of opium pervaded these vast buildings,

which Dr. Corbett[1] assured me did not affect himself or the assistants. The men work ten hours a day, becoming sleepy in the afternoon; but this is only natural in the hot season: they are rather liable to eruptive diseases, possibly engendered by the nature of their occupation.

Even the best East Indian opium is inferior to the Turkish, and owing to peculiarities of climate will probably always be so. It never yields more than five per cent. of morphia, whence its inferiority, but is as good in other respects, and even richer in narcotine.

The care and attention devoted to every department of collecting, testing, manipulating, and packing, is quite extraordinary; and the result has been an impulse to the trade beyond what was anticipated. The natives have been quick at apprehending and supplying the wants of the market, and now there are more demands for licences to grow opium than can be granted. All the opium eaten in India is given out with a permit to licensed dealers, and the drug is so adulterated before it reaches the retailers in the bazaars, that it does not contain one-thirtieth part of the intoxicating power that it did when pure.

Patna is the stronghold of Mahommedanism, and from its central position, its command of the Ganges, and its proximity to Nepal (which latter has been aptly compared to a drawn dagger, pointed at the heart of India), it is an important place. For this reason there are always a European and several Native Regiments stationed there. In the neighbourhood there is little to be seen, and the highly cultivated flat country is unfavourable to native vegetation.

The *mudar* plant (*Calotropis*) was abundant here, but I found that its properties and nomenclature were far form settled points. On the banks of the Ganges, the larger, white-flowered, subarboreous species prevailed; in the interior, and along my whole previous route, the smaller purple-flowered kind was seen. Mr. Davis, of Rotas, was in the habit of using the medicine copiously, and vouched for the cure of eighty cases, chiefly of leprosy, by the *white mudar*, gathered on the Ganges, whilst the purple of Rotas and the neighbourhood was quite inert: Dr. Irvine, again, used the purple only, and found the white inert. The European and native doctors, who knew the two plants, all gave the pre-

[1] I am greatly indebted to Mr. Oldfield, the Opium Agent, and to Dr. Corbett, for a complete set of specimens, implements, and drawings, illustrating the cultivation and manufacture of Opium. They are exhibited in the Kew Museum of Economic Botany.

ference to the *white*; except Dr. Irvine, whose experience over various parts of India is entitled to great weight.

March 29.—Dropped down the river, experiencing a succession of east and north-east winds during the whole remainder of the voyage. These winds are very prevalent throughout the month of March, and they rendered the passage in my sluggish boat sufficiently tedious. In other respects I had but little bad weather to complain of: only one shower of rain occurred, and but few storms of thunder and lightning. The stream is very strong, and its action on the sand-banks conspicuous. All night I used to hear the falling cliffs precipitated with a dull heavy splash into the water,—a pretty spectacle in the day-time, when the running current is seen to carry a cloud of white dust, like smoke, along its course.

The Curruckpore hills, the northern boundary of the gneiss and granite range of Paras-nath, are first seen in the distance, and then throwing out low loosely timbered spurs towards the river; but no rock or hill comes close to the banks till near Monghyr, where two islets of rock rise out of the bed of the river. They are of stratified quartz, dipping, at a high angle, to the south-east; and, as far as I could observe, quite barren, each crowned with a little temple. The swarm of boats from below Patna to this place was quite incredible.

April 1.—Arrived at Monghyr, by far the prettiest town I had seen on the river, backed by a long range of wooded hills,—detached outliers of which rise in the very town. The banks are steep, and they appear more so owing to the fortifications, which are extensive. A number of large, white, two-storied houses, some very imposing, and perched on rounded or conical hills, give a European aspect to the place.

Monghyr is celebrated for its iron manufactures, especially of muskets, in which respect it is the Birmingham of Bengal. Generally speaking, these weapons are poor, though stamped with the first English names. A native workman will, however, if time and sufficient reward be given, turn out a first-rate fowling-piece. The inhabitants are reported to be sad drunkards, and the abundance of toddy-palms was quite remarkable. The latter (here the *Phœnix sylvestris*) I never saw wild, but it is considered to be so in N.W. India; it is still a doubtful point whether it is the same as the African species. In the morning of the following day I went to the hot springs of Seeta-kobnd (wells of Seeta), a few miles south of the town. The hills are hornstone and quartz, stratified and dipping southerly with a very high angle; they are

very barren, and evidently identical with those on the south bank of the Soane; skirting, in both cases, the granite and gneiss range of Paras-nath. The alluvium on the banks of the Ganges is obviously an aqueous deposit subsequent to the elevation of these hills, and is perfectly plane up to their bases. The river has its course through the alluvium, like the Soane. The depth of the former is in many places upwards of 100 feet, and the kunker pebbles it contains are often disposed in parallel undulating bands. It nowhere contains sand pebbles or fossils; concretions of lime (kunker) alone interrupting its uniform consistence. It attains

MONGHYR ON THE GANGES, WITH THE CURRUCKPORE HILLS IN THE DISTANCE.

its greatest thickness in the valleys of the Ganges and the Soane, gradually sloping up to the Himalaya and Curruckpore hills on either flank. It is, however, well developed on the Kymore and Paras-nath hills, 1,200 to 1,500 feet above the Ganges valley, and I have no doubt was deposited in very deep water, when the relative positions of these mountains to the Ganges and Soane valleys were the same that they are now. Like every other part of the surface of India, it has suffered much from denudation, especially on the above-named mountains, and around their bases, where

various rocks protrude through it. Along the Ganges again, its surface is an unbroken level between Chunar and the rocks of Monghyr. The origin of its component mineral matter must be sought in the denudation of the Himalayas within a very recent geological period. The contrast between the fertility of the alluvium and the sterility of the protruded quartzy rocks is very striking, cultivation running up to these fields of stones, and suddenly stopping.

Unlike the Soorujkoond hot-springs, those of Seetakoond rise in a plain, and were once covered by a handsome temple. All the water is collected in a tank, some yards square, with steps leading down to it. The water, which is clear and tasteless (temp. 104°), is so pure as to be exported copiously, and the Monghyr manufactory of soda-water presents the anomaly of owing its purity to Seeta's ablutions.

On my passage down the river I passed the picturesque rocks of Sultangunj; they are similar to those of Monghyr, but very much larger and loftier. One, a round-headed mass, stands on the bank, capped with a triple-domed Mahommedan tomb, palms, and figs. The other, which is far more striking, rises isolated in the bed of the river, and is crowned with a Hindoo temple, its pyramidal cone surmounted with a curious pile of weathercocks, and two little banners. The current of the Ganges is here very strong, and runs in deep black eddies between the rocks.

Though now perhaps eighty or a hundred yards from the shore, this islet must have been recently a peninsula, for it retains a portion of the once connecting bank of alluvium, in the form of a short flat-topped cliff, about thirty feet above the water. Some curious looking sculptures on the rocks are said to represent Naragur (or Vishnu), Suree and Sirooj; but to me they were quite unintelligible. The temple is dedicated to Naragur, and inhabited by Fakirs; it is the most holy on the Ganges.

April 5.—I arrived at Bhagulpore, and took up my quarters with my friend Mr. Grant, till he should arrange my dawk for Sikkim. The town has been supposed to be the much-sought Palibothra, and a dirty stream hard by (the Chundum), the Eranoboas; but Mr. Ravenshaw has now brought all existing proofs to bear on Patna and the Soane. It is, like most hilly places in India south of the Himalaya, the seat of much Jain worship; and the temples on Mount Manden,[1] a few miles off, are said to have been 540 in

[1] For the following information about Bhagulpore and its neighbourhood, I am indebted chiefly to Col. Francklin's essay in the Asiatic Researches; and the late Major Napleton and Mr. Pontet.

number. At the assumed summer-palaces of the kings of Palibothra the ground is covered with agates, brought from the neighbouring hills, which were, in a rough state, let into the walls of the buildings. These agates perfectly resemble the Soane pebbles, and they assist in the identification of these flanking hills with those of the latter river.

Again, near the hills, the features of interest are very numerous. The neighbouring mountains of Curruckpore, which are a portion of the Rajmahal and Paras-nath range, are peopled by tribes representing the earliest races of India, prior to the invasion of young Rama, prince of Oude, who, according to the legend, spread Brahminism with his conquests, and won the hand of King Jannuk's daughter, Seeta, by bending her father's bow. These people are called Coles, a middle-sized, strong, very dark, and black-haired race, with thick lips: they have no vocation but collecting iron from the soil, which occurs abundantly in nodules. They eat flesh, whether that of animals killed by themselves, or of those which have died a natural death, and mix with Hindoos, but not with Mussulmen. There are other tribes, vestiges of the Tamulian race, differing somewhat in their rites from these, and approaching, in their habits, more to the Hindoos; but all are timorous and retiring

The hill-rangers, or Bhagulpore-rangers, are all natives of the Rajmahal hills, and form a local corps maintained by the Company for the protection of the district. For many years these people were engaged in predatory excursions, which, owing to the nature of the country, were checked with great difficulty. The plan was therefore conceived, by an active magistrate in the district, of embodying a portion into a military force, for the protection of the country from invasions of their own tribes; and this scheme has answered perfectly.

To me the most interesting object in Bhagulpore was the Horticultural Gardens, whose origin and flourishing condition are due to the activity and enterprise of the late Major Napleton, commander of the hill-rangers. The site is good, consisting of fifteen acres, that were, four years ago, an indigo field, but form now a smiling garden. About fifty men are employed; and the number of seeds and vegetables annually distributed is very great. Of trees the most conspicuous are the tamarind, *Tecoma jasminoides*, *Erythrina*, *Adansonia*, *Bombax*, teak, banyan, peepul, *Sissoo*, *Casuarina*, *Terminalia*, *Melia*, *Bauhinia*. Of introduced species English and Chinese flat peaches (pruned to the centre to let the sun in), Mangos of various sort, *Eugenia Jambos*, various Anonas,

Litchi, Loquat and Longan, oranges, *Sapodilla*; apple, pear, both succeeding tolerably; various Cabool and Persian varieties of fruit-trees; figs, grapes, guava, apricots, and jujube. The grapes looked extremely well, but they require great skill and care in the management. They form a long covered walk, with a row of plantains on the W. side to diminish the effects of the hot winds, but even with this screen, the fruits on that side are inferior to that on the opposite trellis. Easterly winds, again, being moist, blight these and other plants, by favouring the abundant increase of insects, and causing the leaves to curl and fall off; and against this evil there is no remedy. With a clear sky the mischief is not great; under a cloudy one the prevalence of such winds is fatal to the crop. The white ant sometime attacks the stems, and is best checked by washing the roots with lime-water, yellow arsenic, or tobacco-water. Numerous Cerealia, and the varieties of cotton, sugar-cane, &c. all thrive extremely well; so do many of our English vegetables. Cabbages, peas, and beans are much injured by the caterpillars of a *Pontia*, like our English "White;" raspberries, currants, and gooseberries will not grow at all.

The seeds were all deposited in bottles, and hung round the walls of a large airy department; and for cleanliness and excellence of kind they would bear comparison with the best seedsman's collection in London. Of English garden vegetables, and varieties of the Indian Cerealia, and leguminous plants, Indian corn, millets, rice, &c., the collections for distribution were extensive.

The manufacture of economic products is not neglected. Excellent coffee is grown; and arrow-root, equal to the best West Indian, is prepared, at 1*s.* 6*d.* per bottle of twenty-four ounces,—about a fourth of the price of that article in Calcutta.

In most respects the establishment is a model of what such institutions ought to be in India; not only of real practical value, in affording a good and cheap supply of the best culinary and other vegetables that the climate can produce, but as showing to what departments efforts are best directed. Such gardens diffuse a taste for the most healthy employments, and offer an elegant resource for the many unoccupied hours which the Englishman in India finds upon his hands. They are also schools of gardening; and a simple inspection of what has been done at Bhagulpore is a valuable lesson to any person about to establish a private garden of his own.

I often heard complaints made of the seeds distributed from these gardens not vegetating freely in other parts of India, and it is not to be expected that they should retain their vitality unimpaired

through an Indian rainy season; but on the other hand I almost invariably found that the planting and tending had been left to the uncontrolled management of native gardeners, who with a certain amount of skill in handicraft are, from habits and prejudices, singularly unfit for the superintendence of a garden.

CHAPTER IV.

Leave Bhagulpore—Kunker—Colgong—Himalaya, distant view of—Cosi, mouth of—Difficult navigation—Sand-storms—Caragola-Ghat—Purnea—Ortolans—Mâhanuddee, transport of pebbles, &c.—Betel-pepper, cultivation of—Titalya—Siligoree—View of outer Himalaya—Terai—Mechis—Punkabaree—Foot of mountains—Ascent to Darjeeling—Cicadas—Leeches—Animals—Kursiong, spring vegetation of—Pacheem—Arrive at Darjeeling—Darjeeling, origin and settlement of—Grant of land from Rajah—Dr. Campbell appointed superintendent—Dewan, late and present—Aggressive conduct of the latter—Increase of the station—Trade—Titalya fair—Healthy climate for Europeans and children—Invalids, diseases prejudicial to.

I TOOK, as it were, a new departure on Saturday, April the 8th, my dawk being laid on that day from Caragola-Ghat, about thirty miles down the river, for the foot of the Himalaya range and Darjeeling.

Passing the pretty villa-like houses of the English residents, the river-banks reassumed their wonted features: the hills receded from the shore; and steep clay cliffs, twenty to fifty feet high, on one side, opposed long sandy shelves on the other. Kunker was still most abundant, especially in the lower bed of the banks, close to the (now very low) water. The strata containing it were much undulated, but not uniformly so; horizontal layers over or underlying the disturbed ones. At Colgong, conical hills appear, and two remarkable sister-rocks start out of the river, the same in structure with those of Sultangunj. A boisterous current swirls round them, strong even at this season, and very dangerous in the rains, when the swollen river is from twenty-eight to forty feet deeper than now. We landed opposite the rocks, and proceeded to the residence of Mr. G. Barnes, prettily situated on one of the conical elevations characteristic of the geology of the district. The village we passed through had been recently destroyed by fire; and nothing but the clay outer walls and curious-looking partition walls remained, often white-washed and daubed with figures in red of the palm of the hand, elephant, peacock, tiger,—a sort of rude fresco-painting. We did not arrive till past mid-day,

and the boat, with my palkee and servant, not having been able to face the gale, I was detained till the middle of the following day. Mr. Barnes and his brother proved most agreeable companions,—very luckily for me, for it requires no ordinary philosophy to bear being storm-stayed on a voyage, with the prospect of paying a heavy demurrage for detaining the dawk, and the worse one of finding the bearers given to another traveller when you arrive at the rendezvous. The view from Mr. Barnes' house is very fine: it commands the river and its rocks; the Rajmahal hills to the east and south; broad acres of indigo and other crops below; long lines of palm-trees, and groves of mango, banana, tamarind, and other tropical trees, scattered close around and in the distance. In the rainy season, and immediately after, the snowy Himalaya are distinctly seen on the horizon, fully 170 miles off. Nearly opposite, the Cosi river enters the Ganges, bearing (considering its short course) an enormous volume of water, comprising the drainage of the whole Himalaya between the two giant peaks of Kinchinjunga in Sikkim, and Gossain-Than in Nepal. Even at this season, looking from Mr. Barnes' eyrie over the bed of the Ganges, the enormous expanses of sand, the numerous shifting islets, and the long spits of mud betray the proximity of some very restless and resistless power. During the rains, the scene must indeed be extraordinary, when the Cosi lays many miles of land under water, and pours so vast a quantity of detritus into the Ganges that long islets are heaped up and swept away in a few hours; and the latter river becomes all but unnavigable. Boats are caught in whirlpools, formed without a moment's warning, and sunk ere they have spun round thrice in the eddies; and no part of the inland navigation of India is so dreaded or dangerous, as the Ganges at its junction with the Cosi.

Rain generally falls in partial showers at this season, and they are essential to the well-being of the spring crops of indigo. The stormy appearance of the sky, though it proved fallacious, was hailed by my hosts as predicting a fall, which was much wanted. The wind however seemed but to aggravate the drought, by the great body of sand it lifted and swept up the valleys, obscuring the near horizon, and especially concealing the whole delta of the Cosi, where the clouds were so vast and dense, and ascended so high as to resemble another element.

All night the gale blew on, accompanied with much thunder and lightning, and it was not till noon of the 9th that I descried my palkee-boat toiling down the stream. Then I again embarked, taking the lagging boat in tow of my own. Passing the mouths

of the Cosi, the gale and currents were so adverse that we had to bring up on the sand, when the quantity which drifted into the boat rendered the delay as disagreeable as it was tedious. The particles penetrated everywhere, up my nose and down my back, drying my eyelids, and gritting between my teeth. The craft kept bumping on the banks, and being both crazy and leaky, the little comfortless cabin became the refuge of scared rats and cockroaches. In the evening I shared a meal with these creatures, on some provisions my kind friends had put into the boat, but the food was so sandy that I had to bolt my supper!

At night the storm lulled a little, and I proceeded to Caragola Ghat and took up my dawk, which had been twenty-eight hours expecting me, and was waiting, in despair of my arrival, for another traveller on the opposite bank, who however could not cross the river.

Having accomplished thirty miles, I halted at 9 A.M. on the following morning at Purnea, quitting it at noon for Kishengunj. The whole country wore a greener garb than I had seen anywhere south of the Ganges: the climate was evidently more humid, and had been gradually becoming so from Mirzapore. The first decided change was a few miles below the Soane mouth, at Dinapore and Patna; and the few hygrometrical observations I took at Bhagulpore confirmed the increase of moisture. The proximity to the sea and great Delta of the Ganges sufficiently accounts for this; as does the approach to the hills for the still greater dampness and brighter verdure of Purnea. I was glad to feel myself within the influence of the long-looked-for Himalaya; and I narrowly watched every change in the character of the vegetation. A fern, growing by the road-side, was the first and most tangible evidence of this; together with the rarity or total absence of *Butea*, *Boswellia*, *Catechu*, *Grislea*, *Carissa*, and all the companions of my former excursion.

Purnea is a large station, and considered very unhealthy during and after the rains. From it the road passed through some pretty lanes, with groves of planted Guava and a rattan palm (*Calamus*), the first I had seen. Though no hills are nearer than the Himalaya, from the constant alteration of the river-beds, the road undulates remarkably for this part of India, and a jungly vegetation ensues, consisting of the above plants, with the yellow-flowered Cactus replacing the Euphorbias, which were previously much more common. Though still 100 miles distant from the hills, mosses appeared on the banks, and more ferns were just sprouting above ground.

The Bamboo, here cultivated, was a different species from that I had met with in Behar, forming groves of straight trees fifteen to twenty feet high, thin of foliage, and not unlike poplars.

Thirty-six miles from Purnea brought me to Kishengunj, when I found that no arrangements whatever had been made for my dawk, and I was fairly stranded. Luckily a thoughtful friend had provided me with letters to the scattered residents along the road, and I proceeded with one to Mr. Perry, the assistant magistrate of the district,—a gentleman well known for his urbanity, and the many aids he affords to travellers on this neglected line of road. Owing to this being some festival or holiday, it was impossible to get palkee-bearers; the natives were busy catching fish in all the muddy pools around. Some of Mr. Perry's own family also were about to proceed to Darjeeling, so that I had only to take patience, and be thankful for having to exercise it in such pleasant quarters. The Mahanuddee, a large stream from the hills, flows near this place, strewing the surrounding neighbourhood with sand, and from the frequent alterations in its course, causing endless disputes among the landholders. A kind of lark called an Ortolan was abundant: this is not, however, the European delicacy of that name, though a migratory bird; the flocks are large, and the birds so fat, that that they make excellent table game. At this time they were rapidly disappearing; to return from the north in September.

I had just got into bed at night, when the bearers arrived; so bidding a hurried adieu to my kind host, I proceeded onwards.

April 12.—I awoke at 4 A.M., and found my palkee on the ground, and the bearers coolly smoking their hookahs under a tree (it was raining hard): they had carried me the length of their stage, twelve miles, and there were no others to take me on. I had paid twenty-four pounds for my dawk, from Caragola to the hills, to which I had been obliged to add a handsome douceur; so I lost all patience. After waiting and entreating during several hours, I found the head-man of a neighbouring village, and by a further disbursement induced six out of the twelve bearers to carry the empty palkee, whilst I should walk to the next stage; or till we should meet some others. They agreed, and cutting the thick and spongy sheaths of the banana, used them for shoulder-pads: they also wrapped them round the palkee-poles, to ease their aching clavicles. Walking along I picked up a few plants, and fourteen miles further on came again to the banks of the Mahanuddee, whose bed was strewn with pebbles and small boulders, brought thus far from the

mountains (about thirty miles distant). Here, again, I had to apply to the head-man of a village, and pay for bearers to take me to Titalya, the next stage (fourteen miles). Some curious long low sheds puzzled me very much, and on examining them they proved to be for the growth of Pawn or Betel-pepper, another indication of the moisture of the climate. These sheds are twenty to fifty yards long, eight or twelve or so broad, and scarcely five high; they are made of bamboo, wattled all round and over the top. Slender rods are placed a few feet apart, inside, up which the Pepper Vines climb, and quickly fill the place with their deep green glossy foliage. The native enters every morning by a little door, and carefully cleans the plants. Constant heat, damp, and moisture, shelter from solar beams, from scorching heat, and from nocturnal radiation, are thus all procured for the plant, which would certainly not live twenty-four hours if exposed to the climate of this treeless district. Great attention is paid to the cultivation, which is very profitable. Snakes frequently take up their quarters in these hot-houses, and cause fatal accidents.

Titalya was once a military station of some importance, and from its proximity to the hills has been selected by Dr. Campbell (the Superintendent of Darjeeling) as the site for an annual fair, to which the mountain tribes resort, as well as the people of the plains. The Calcutta road to Darjeeling by Dinajpore meets, near here, that by which I had come; and I found no difficulty in procuring bearers to proceed to Siligoree, where I arrived at 6 A.M. on the 13th. Hitherto I had not seen the mountains, so uniformly had they been shrouded by dense wreaths of vapour: here, however, when within eight miles of their base, I caught a first glimpse of the outer range—sombre masses, of far from picturesque outline, clothed everywhere with a dusky forest.

Siligoree stands on the verge of the Terai, that low malarious belt which skirts the base of the Himalaya, from the Sutlej to Brahma-koond in Upper Assam. Every feature, botanical, geological, and zoological, is new on entering this district. The change is sudden and immediate: sea and shore are hardly more conspicuously different; nor from the edge of the Terai to the limit of perpetual snow is any botanical region more clearly marked than this, which is the commencement of Himalayan vegetation. A sudden descent leads to the Mahanuddee river, flowing in a shallow valley, over a pebbly bottom: it is a rapid river, even at this season; its banks are fringed with bushes, and

it is clear and sparkling as a trout stream in Scotland. Beyond it the road winds through a thick brushwood, choked with long grasses, and with but few trees, chiefly of *Acacia*, *Dalbergia Sissoo*, and a scarlet-fruited *Sterculia*. The soil is a red, friable clay and gravel. At this season only a few spring plants were in flower, amongst which a very sweet-scented *Crinum*, Asphodel, and a small *Curcuma*, were in the greatest profusion. Leaves of terrestrial Orchids appeared, with ferns and weeds of hot damp regions. I crossed the beds of many small streams: some were dry, and all very tortuous; their banks were richly clothed with brushwood and climbers of Convolvulus, Vines, *Hiræa*, *Leea*, *Menispermeæ*, *Cucurbitaceæ*, and *Bignoniaceæ*. Their pent-up waters, percolating the gravel beds, and partly carried off by evaporation through the stratum of ever-increasing vegetable mould, must be one main agent in the production of the malarious vapours of this pestilential region. Add to this, the detention of the same amongst the jungly herbage, the amount of vapour in the humid atmosphere above, checking the upward passage of that from the soil, the sheltered nature of the locality at the immediate base of lofty mountains; and there appear to me to be here all necessary elements, which, combined, will produce stagnation and deterioration in an atmosphere loaded with vapour Fatal as this district is, and especially to Europeans, a race inhabit it with impunity, who, if not numerous, do not owe their paucity to any climatic causes. These are the Mechis, often described as a squalid, unhealthy people, typical of the region they frequent; but who are, in reality, more robust than the Europeans in India, and whose disagreeably sallow complexion is deceptive as indicating a sickly constitution. They are a mild, inoffensive people, industrious for Orientals, living by annually burning the Terai jungle and cultivating the cleared spots; and, though so sequestered and isolated, they rather court than avoid intercourse with those whites whom they know to be kindly disposed.

After proceeding some six miles along the gradually ascending path, I came to a considerable stream, cutting its way through stratified gravel, with cliffs on each side fifteen to twenty feet high, here and there covered with ferns, the little *Oxalis sensitiva*, and other herbs. The road here suddenly ascends a steep gravelly hill, and opens out on a short flat, or spur, from which the Himalaya rise abruptly, clothed with forest from the base: the little bungalow of Punkabaree, my immediate destination, nestled in the woods, crowning a lateral knoll, above

PUNKABAREE BUNGALOW AND BASE OF THE SIKKIM HIMALAYA.

which, to east and west, as far as the eye could reach, were range after range of wooded mountains, 6,000 to 8,000 feet high. I here met with the India-rubber tree (*Ficus elastica*); it abounds in Assam, but this is its western limit.

From this steppe, the ascent to Punkabaree is sudden and steep, and accompanied with a change in soil and vegetation. The mica slate and clay slate protrude everywhere, the former full of garnets. A giant forest replaces the stunted and bushy timber of the Terai Proper; of which the *Duabanga* and *Terminalias* form the prevailing trees, with *Cedrela* and *Gordonia Wallichii*. Smaller timber and shrubs are innumerable; a succulent character pervades the bushes and herbs, occasioned by the prevalence of *Urticeæ*. Large bamboos rather crest the hills than court the deeper shade, and of the latter there is abundance, for the torrents cut a straight, deep, and steep course down the hill flanks: the gulleys they traverse are choked with vegetation and bridged by fallen trees, whose trunks are rich clothed with *Dendrobium Pierardi* and other epiphytical Orchid with pendulous *Lycopodia* and many ferns, *Hoya*, *Scitamineæ*, a similar types of the hottest and dampest climates.

The bungalow at Punkabaree was good—which was well, my luggage-bearers had not come up, and there were no sig of them along the Terai road, which I saw winding below m My scanty stock of paper being full of plants, I was reduced the strait of botanising, and throwing away the specimens. Th forest was truly magnificent along the steep mountain sides. Th apparently large proportion of deciduous trees was far mo considerable than I had expected; partly, probably, due to t abundance of the *Dillenia*, *Cassia*, and *Sterculia*, whose copio fruit was all the more conspicuous from the leafless condition o the plant. The white or lilac blossoms of the convolvulus-lik *Thunbergia*, and other *Acanthaceæ*, were the predominant features of the shrubby vegetation, and very handsome.

All around, the hills rise steeply five or six thousand feet, clothed in a dense deep-green dripping forest. Torrents rush down the slopes, their position indicated by the dipping of the forest into their beds, or the occasional cloud of spray rising above some more boisterous part of their course. From the road, at and a little above Punkabaree, the view is really superb, and very instructive. Behind (or north) the Himalaya rise in steep confused masses. Below, the hill on which I stood, and the ranges as far as the eye can reach east and west, throw spurs or to the plains of India. These are very thickly wooded.

nclose broad, dead-flat, hot and damp valleys, apparently covered with a dense forest. Secondary spurs of clay and gravel, like that immediately below Punkabaree, rest on the bases of the mountains, and seem to form an intermediate neutral ground between flat and mountainous India. The Terai district forms a very irregular belt, scantily clothed, and intersected by innumerable rivulets from the hills, which unite and divide again on the flat, till, emerging from the region of many trees, they enter the plains, following devious courses, which glisten like silver threads. The whole horizon is bounded by the sea-like expanse of the plains, which stretch away into the region of sunshine and fine weather, in one boundless flat.

In the distance, the courses of the Teesta and Cosi, the great drainers of the snowy Himalayas, and the recipients of innumerable smaller rills, are with difficulty traced at this, the dry season. The ocean-like appearance of this southern view is even more nspicuous in the heavens than on the land, the clouds arranging emselves after a singularly sea-scape fashion. Endless strata n in parallel ribbons over the extreme horizon; above these, attered cumuli, also in horizontal lines, are dotted against a ear grey sky, which gradually, as the eye is lifted, passes into deep cloudless blue vault, continuously clear to the zenith; ere the cumuli, in white fleecy masses, again appear; till, in the rthern celestial hemisphere, they thicken and assume the leaden e of nimbi, discharging their moisture on the dark forest-clad lls around. The breezes are south-easterly, bringing that vapour om the Indian Ocean, which is rarefied and suspended aloft er the heated plains, but condensed into a drizzle when it ikes the cooler flanks of the hills, and into heavy rain when it eets their still colder summits. Upon what a gigantic scale loes nature here operate! Vapours, raised from an ocean whose nearest shore is more than 400 miles distant, are safely transported without the loss of one drop of water to support the rank luxuriance of this far distant region. This and other offices fulfilled, the waste waters are returned, by the Cosi and Teesta, to the ocean, and again exhaled, exported, expended, re-collected, and returned.

The soil and bushes everywhere swarmed with large and troublesome ants and enormous earthworms. In the evening the noise of the great *Cicadæ* in the trees was almost deafening. They burst suddenly into full chorus, with a voice so harshly creaking, so dissonant, and so unearthly, that in these solitary ts I could not help being startled. In general character the

note was very similar to that of other *Cicadæ*. They ceased as suddenly as they commenced. On the following morning my baggage arrived, and, leaving my palkee, I mounted a pony kindly sent for me by Mr. Hodgson, and commenced a very steep ascent of about 3,000 feet, winding along the face of a steep, richly-wooded valley. The road zigzags extraordinarily in and out of the innumerable lateral ravines, each with its watercourse, dense jungle, and legion of leeches; the bite of these blood-suckers gives no pain, but is followed by considerable effusion of blood. They puncture through thick worsted stockings, and even trousers, and, when full, roll in the form of a little soft ball into the bottom of the shoe, where their presence is hardly felt in walking.

Not only are the roadsides rich in plants, but native paths cutting off all the zigzags, run in straight lines up the steepes hill-faces, and thus double the available means for botanising and it is all but impossible to leave the paths of one kind o other, except for a yard or two up the rocky ravines. Elephants tigers, and occasionally the rhinoceros, inhabit the foot of these hills, with wild boars, leopards, &c.; but none are numerous The elephant's path is an excellent specimen of engineering—th opposite of the native track, for it winds judiciously.

At about 1,000 feet above Punkabaree the vegetation is ver rich, and appears all the more so from the many turnings of th road, affording glorious prospects of the foreshortened tropica forests. The prevalent timber is gigantic, and scaled by climbin *Leguminosæ*, as *Bauhinias* and *Robinias*, which sometimes sheat the trunks, or span the forest with huge cables, joining tree t tree. Their trunks are also clothed with parasitical Orchids, an still more beautifully with Pothos (*Scindapsus*), Peppers, *Gnetum* Vines, Convolvulus, and *Bignoniæ*. The beauty of the drapery of the Pothos-leaves is pre-eminent, whether for the graceful folds the foliage assumes, or for the liveliness of its colour. Of the more conspicuous smaller trees, the wild banana is the most abundant, its crown of very beautiful foliage contrasting with the smaller-leaved plants amongst which it nestles; next comes a screw-pine (*Pandanus*) with a straight stem and a tuft of leaves, each eight or ten feet long, waving on all sides. *Araliaceæ*, with smooth or armed slender trunks, and *Mappa*-like *Euphorbiaceæ*, spread their long petioles horizontally forth, each terminated with an ample leaf some feet in diameter. Bamboo abounds everywhere; its dense tufts of culms, 100 feet and upwards high, are as thick as a man's thigh at the base. Twenty or thirty species of ferns (including a tree-fern) were luxuriant and handsom

Foliaceous lichens and a few mosses appeared at 2,000 feet. Such is the vegetation of the roads through the tropical forests of the Outer-Himalaya.

At about 4,000 feet the road crossed a saddle, and ran along the narrow crest of a hill, the top of that facing the plains of India, and over which is the way to the interior ranges, amongst which Darjeeling is placed, still twenty-five miles off. A little below this a great change had taken place in the vegetation—marked, first, by the appearance of a very English-looking bramble, which, however, by way of proving its foreign origin, bore a very good yellow fruit, called here the "yellow raspberry." Scattered oaks, of a noble species, with large lamellated cups and magnificent foliage, succeeded; and along the ridge of the mountain to Kursiong (a dawk bungalow at about 4,800 feet), the change in the flora was complete.

The spring of this region and elevation most vividly recalled that of England. The oak flowering, the birch bursting into leaf, the violet, *Chrysosplenium*, *Stellaria* and *Arum*, *Vaccinium*, wild strawberry, maple, geranium, bramble. A colder wind blew here; mosses and lichens carpeted the banks and roadsides; the birds and insects were very different from those below; and everything proclaimed the marked change in elevation, and not only in this, but in season, for I had left the winter of the tropics and here encountered the spring of the temperate zone.

The flowers I have mentioned are so notoriously the harbingers of a European spring that their presence carries one home at once; but, as species, they differ from their European prototypes, and are accompanied at this elevation (and for 2,000 feet higher up) with tree-fern, Pothos, bananas, palms, figs, pepper, numbers of epiphytal Orchids, and similar genuine tropical genera. The uniform temperature and humidity of the region here favour the extension of tropical plants into a temperate region; exactly as the same conditions cause similar forms to reach higher latitudes in the southern hemisphere (as in New Zealand, Tasmania, South Chili, &c.) than they do in the northern.

Along this ridge I met with the first tree-fern. This species seldom reaches the height of forty feet; the black trunk is but three or four in girth, and the feathery crown is ragged in comparison with the species of many other countries: it is the *Alsophila gigantea*, and ascends nearly to 7,000 feet elevation.

Kursiong bungalow, where I stopped for a few hours, is superbly placed, on a narrow mountain ridge. The west window looks down the valley of the Balasun river, the east into that of the

Mahanuddee; both of these rise from the outer range, and flow in broad, deep, and steep valleys (about 4,000 feet deep) which give them their respective names, and are richly wooded from the Terai to their tops. Till reaching this spur, I had wound upwards along the western slope of the Mahanuddee valley. The ascent from the spur at Kursiong to the top of the mountain (on the northern face of which Darjeeling is situated) is along the eastern slope of the Balasun.

From Kursiong a very steep zigzag leads up the mountain, through a magnificent forest of chestnut, walnut, oaks, and laurels. It is difficult to conceive a grander mass of vegetation—the straight shafts of the timber-trees shooting aloft, some naked and clean, with grey, pale, or brown bark; others literally clothed for yards with a continuous garment of epiphytes, one mass of blossoms, especially the white Orchids *Cœlogynes*, which bloom in a profuse manner, whitening their trunks like snow. More bulky trunks bore masses of interlacing climber, *Araliaceæ*, *Leguminosæ*, Vines, and *Menispermeæ*, Hydrangea, and Peppers, enclosing a hollow, once filled by the now strangled supporting tree, which had long ago decayed away. From the sides and summit of these, supple branches hung forth, either leafy or naked; the latter resembling cables flung from one tree to another, swinging in the breeze, their rocking motion increased by the weight of great bunches of ferns or Orchids, which were perched aloft in the loops. Perpetual moisture nourishes this dripping forest, and pendulous mosses and lichens are met with in profusion.

Two thousand feet higher up, near Mahaldiram (whence the last view of the plains is gained), European plants appear—Berberry, *Paris*, &c.; but here night gathered round, and I had still ten miles to go to the nearest bungalow, that of Pacheem. The road still led along the eastern slope of the Balasun valley, which was exceedingly steep, and so cut up by ravines, that it winds in and out of gulleys almost narrow enough to be jumped across.

It was very late before I arrived at Pacheem bungalow, the most sinister-looking rest-house I ever saw, stuck on a little cleared spur of the mountain, surrounded by dark forests, overhanging a profound valley, and enveloped in mists and rain, and hideous in architecture, being a miserable attempt to unite the Swiss cottage with the suburban gothic; it combined a maximum of discomfort with a minimum of good looks or good cheer. I was some time in finding the dirty housekeeper, in an outhouse hard by, and then in waking him. As he led me up the crazy verandah, and into a broad ghostly room, without glass in

the windows, or fire, or any one comfort, my mind recurred to the stories told of the horrors of the Hartz forest, and of the benighted traveller's situation therein. Cold sluggish beetles hung to the damp walls—and these I immediately secured. After due exertions and perseverance with the damp wood, a fire smoked lustily, and, by cajoling the gnome of a housekeeper, I procured the usual roast fowl and potatoes, with the accustomed sauce of a strong smoky and singed flavour.[1]

Pacheem stands at an elevation of nearly 7,300 feet, and as I walked out on the following morning I met with English-looking plants in abundance, but was too early in the season to get aught but the foliage of most. *Chrysosplenium*, violet, *Lobelia*, a small geranium, strawberry, five or six kinds of bramble, *Arum*, *Paris*, *Convallaria*, *Stellaria*, *Rubia*, *Vaccinium*, and various *Gnaphalia*. Of small bushes, cornels, honeysuckles, and the ivy tribe predominated, with *Symplocos* and *Skimmia*, *Eurya*, bushy brambles, having simple or compound green or beautifully silky foliage; *Hypericum*, Berberry, Hydrangea, Wormwood, *Adamia cyanea*, *Viburnum*, Elder, dwarf bamboo, &c.

The climbing plants were still *Panax* or *Aralia*, *Kadsura*, *Saurauja*, *Hydrangea*, Vines, *Smilax*, *Ampelopsis*, *Polygona*, and, most beautiful of all, *Stauntonia*, with pendulous racemes of lilac blossoms. Epiphytes were rarer, still I found white and purple *Cœlogynes*, and other Orchids, and a most noble white Rhododendron, whose truly enormous and delicious lemon-scented blossoms strewed the ground. The trees were one half oaks, one quarter Magnolias, and nearly another quarter laurels, amongst which grew Himalayan kinds of birch, alder, maple, holly, bird-cherry, common cherry, and apple. The absence of *Leguminosæ* was most remarkable, and the most prominent botanical feature in the vegetation of this region; it is too high for the tropical tribes of the warmer elevations, too low for the Alpines, and probably too moist for those of temperate regions; cool, equable, humid climates being generally unfavourable to that order. Clematis was rare, and other *Ranunculaceæ* still more so. *Cruciferæ* were absent, and, what was still more remarkable, I found very few native species of grasses. Both *Poa annua* and white Dutch clover flourished where accidentally disseminated, but only in artificially cleared spots. Of ferns I collected about sixty species, chiefly of temperate genera. The supremacy of this

[1] Since writing the above a comfortable house has been erected at Senadah, the name now given to what was called Pacheem Bungalow.

temperate region consists in the infinite number of forest trees, in the absence (in the usual proportion, at any rate) of such common orders as *Compositæ*, *Leguminosæ*, *Cruciferæ*, and *Ranunculaceæ*, and of Grasses amongst Monocotyledons, and in the predominance of the rarer and more local families, as those of Rhododendron, Camellia, Magnolia, Ivy, Cornel, Honeysuckle, Hydrangea, Begonia, and Epiphytic orchids.

From Pacheem the road runs in a northerly direction to Darjeeling, still along the Balasun valley, till the saddle of the great mountain Sinchul is crossed. This is narrow, stretching east and west, and from it a spur projects northwards for five or six miles, amongst the many mountains still intervening between it and the snows. This saddle (alt. 7,400 feet) crossed, one is fairly amongst the mountains: the plains behind are cut off by it; and in front the snows may be seen when the weather is propitious. The valleys on this side of the mountain run northwards, and discharge their streams into great rivers, which, coming from the snow, wind amongst the hills, and debouch into the Teesta, to the east, where it divides Sikkim from Bhotan.

Darjeeling station occupies a narrow ridge, which divides into two spurs, descending steeply to the bed of the Great Rungeet river, up whose course the eye is carried to the base of the great snowy mountains. The ridge itself is very narrow at the top, along which most of the houses are perched, while others occupy positions on its flanks, where narrow *locations* on the east, and broader ones on the west, are cleared from wood. The valleys on either side are at least 6,000 feet deep, forest-clad to the bottom, with very few and small level spots, and no absolute precipice; from their flanks project innumerable little spurs, occupied by native clearings.

My route lay along the east flank, overhanging the valley of the Rungmo river. Looking east, the amphitheatre of hills from the ridge I had crossed was very fine; enclosing an area some four miles across and 4,000 feet deep, clothed throughout with an impenetrable, dark forest: there was not one clear patch except near the very bottom, where were some scattered hamlets of two or three huts each. The rock is everywhere near the surface, and the road has been formed by blasting at very many places. A wooded slope descends suddenly from the edge of the road, while, on the other hand, a bank rises abruptly to the top of the ridge, alternately mossy, rocky, and clayey, and presenting a good geological section, all the way along, of the nucleus of Darjeeling spur, exposing broken masses of gneiss. As I descended I came

upon the upper limit of the chesnut, a tree second in abundance to the oak, gigantic, tall, and straight in the trunk.

I arrived at Darjeeling on the 16th of April; a showery, cold month at this elevation. I was so fortunate as to find Mr. Charles Barnes (brother of my friend at Colgong), the sole tenant of a long, cottage-like building, divided off into pairs of apartments, which are hired by visitors. It is usual for Europeans to bring a full establishment of servants (with bedding, &c.) to such stations, but I had not done so, having been told that there was a furnished hotel in Darjeeling; and I was, therefore, not a little indebted to Mr. Barnes for his kind invitation to join his mess. As he was an active mountaineer, we enjoyed many excursions together, in the two months and a half during which we were companions.

Dr. Campbell procured me several active native (Lepcha) lads as collectors, at wages varying from eight to twenty shillings a month; these either accompanied me on my excursions, or went by themselves into the jungles to collect plants, which I occupied myself in drawing, dissecting, and ticketing: while the preserving of them fell to the Lepchas, who, after a little training, became, with constant superintendence, good plant-driers. Even at this season (four weeks before the setting in of the rains) the weather was very uncertain, so that the papers had generally to be dried by the fire.

The hill-station or Sanatarium of Darjeeling owes its origin (like Simla, Mussooree, &c.) to the necessity that exists in India of providing places where the health of Europeans may be recruited by a more temperate climate. Sikkim proved an eligible position for such an establishment, owing to its proximity to Calcutta, which lies but 370 miles to the southward; whereas the north-west stations mentioned above are upwards of a thousand miles from that city. Darjeeling ridge varies in height from 6,500 to 7,500 feet above the level of the sea; 8,000 feet being the elevation at which the mean temperature most nearly coincides with that of London, viz., 50°.

Sikkim was, further, the only available spot for a Sanatarium throughout the whole range of the Himalaya, east of the extreme western frontier of Nepal; being a protected state, and owing no allegiance, except to the British Government; which, after the Rajah had been driven from the country by the Ghorkas, in 1817, replaced him on his throne, and guaranteed him the sovereignty. Our main object in doing this was to retain Sikkim as a fender between Nepal and Bhotan; and but for this policy the aggressive Nepalese would, long ere this, have possessed themselves of

Sikkim, Bhotan, and the whole Himalaya, eastwards to the borders of Burmah.[1]

From 1817 to 1828 no notice was taken of Sikkim, till a frontier dispute occurred between the Lepchas and Nepalese, which was referred (according to the terms of the treaty) to the British Government. During the arrangement of this, Darjeeling was visited by a gentleman of high scientific attainments, Mr. J. W. Grant, who pointed out its eligibility as a site for a Sanatarium to Lord William Bentinck, then Governor-General; dwelling especially upon its climate, proximity to Calcutta, and accessibility; on its central position between Tibet, Bhotan Nepal, and British India; and on the good example a peaceably-conducted and well-governed station would be to our turbulent neighbours in that quarter. The suggestion was cordially received, and Major Herbert (the late eminent Surveyor-General of India) and Mr. Grant were employed to report further on the subject.

The next step taken was that of requesting the Rajah to cede a tract of country which should include Darjeeling, for an equivalent in money or land. His first demand was unreasonable; but on further consideration he surrendered Darjeeling unconditionally, and a sum of £300 per annum was granted to him as an equivalent for what was then a worthless uninhabited mountain. In 1840 Dr. Campbell was removed from Nepal as superintendent of the new station, and was entrusted with the charge of the political relations between the British and Sikkim Government.

Once established, Darjeeling rapidly increased. Allotments of land were purchased by Europeans for building dwelling-houses; barracks and a bazaar were formed, with accommodation for invalid European soldiers; a few official residents, civil and military, formed the nucleus of a community, which was increased by retired officers and their families, and by temporary visitors in search of health, or the luxury of a cool climate and active exercise.

For the first few years matters went on smoothly with the Rajah, whose minister (or Dewan) was upright and intelligent; but the latter, on his death, was succeeded by the present Dewan, a Tibetan, and a relative of the Ranee (or Rajah's wife); a man unsurpassed for insolence and avarice, whose aim was to monopo-

[1] Of such being their wish the Nepalese have never made any secret, and they are said to have asked permission from the British to march an army across Sikkim for the purpose of conquering Bhotan, offering to become more peaceable neighbours to us than the Bhotanese are. Such they would doubtless have proved, but the Nepal frontier is considered broad enough already.

lise the trade of the country, and to enrich himself at its expense. Every obstacle was thrown by him in the way of a good understanding between Sikkim and the British Government. British subjects were rigorously excluded from Sikkim; every liberal offer for free trade and intercourse was rejected, generally with insolence; merchandise was taxed, and notorious offenders, refugees from the British territories, were harboured; despatches were detained; and the Vakeels, or Rajah's representatives, were chosen for their insolence and incapacity. The conduct of the Dewan throughout was Indo-Chinese; assuming, insolent, aggressive, never perpetrating open violence, but by petty insults effectually preventing all good understanding. He was met by neglect or forbearance on the part of the Calcutta Government, and by patience and passive resistance at Darjeeling. Our inaction and long-suffering were taken for weakness, and our concessions for timidity. Such has been our policy in China, Siam, and Burmah, and in each instance the result has been the same. Had it been insisted that the terms of the treaty should be strictly kept, and had the first act of insolence been noticed, we should have maintained the best relations with Sikkim, whose people and rulers (with the exception of the Dewan and his faction) have proved themselves friendly throughout, and most anxious for unrestricted communication.

These political matters have not, however, prevented the rapid increase of Darjeeling; the progress of which, during the two years I spent in Sikkim, resembled that of an Australian colony, not only in amount of building, but in the accession of native families from the surrounding countries. There were not a hundred inhabitants under British protection when the ground was transferred; there are now four thousand. At the former period there was no trade whatever; there is now a very considerable one, in musk, salt, gold-dust, borax, soda, woollen cloths, and especially in ponies, of which the Dewan in one year brought on his own account upwards of fifty into Darjeeling.[1] The trade has been greatly increased by the annual fair which Dr. Campbell has established at the foot of the hills, to which many thousands of natives flock from all quarters, and which exercises a most beneficial influence throughout the neighbouring territories. At this,

[1] The Tibetan pony, though born and bred 10,000 to 14,000 feet above the sea, is one of the most active and useful animals in the plains of Bengal, powerful and hardy, and when well trained early, docile, although by nature vicious and obstinate.

prizes (in medals, money, and kind) are given for agricultural implements and produce, stock, &c., by the originator and a few friends; a measure attended with eminent success.

In estimating in a sanitary point of view the value of any health-station, little reliance can be placed on the general impressions of invalids, or even of residents; the opinion of each varies with the nature and state of his complaint, if ill, or with his idiosyncrasy and disposition, if well. I have seen prejudiced invalids rapidly recovering, in spite of themselves, and all the while complaining in unmeasured terms of the climate of Darjeeling, and abusing it as killing them. Other are known who languish under the heat of the plains at one season, and the damp at another; and who, though sickening and dying under its influence, yet consistently praise a tropical climate to the last. The opinions of those who resort to Darjeeling in health, differ equally; those of active minds invariably thoroughly enjoy it, while the mere lounger or sportsman mopes. The statistical tables afford conclusive proofs of the value of the climate to Europeans suffering from acute diseases, and they are corroborated by the returns of the medical officer in charge of the station. With respect to its suitability to the European constitution I feel satisfied, and that much saving of life, health, and money would be effected were European troops drafted thither on their arrival in Bengal, instead of being stationed in Calcutta, exposed to disease, and temptation to those vices which prove fatal to so many hundreds. This, I have been given to understand, was the view originally taken by the Court of Directors, but it has never been carried out.

I believe that children's faces afford as good an index as any to the healthfulness of a climate, and in no part of the world is there a more active, rosy, and bright young community than at Darjeeling. It is incredible what a few weeks of that mountain air does for the Indian-born children of European parents: they are taken there sickly, pallid or yellow, soft and flabby, to become transformed into models of rude health and activity.

There are, however, disorders to which the climate (in common with all damp ones) is not at all suited; such are especially dysentery, bowel complaints, and liver complaints of long standing; which are not benefited by a residence on these hills, though how much worse they might have become in the plains is not shown. I cannot hear that the climate aggravates, but it certainly does not remove them. Whoever is suffering from the debilitating effects of any of the multifarious acute maladies of the plains, finds instant relief, and acquires a stock of health that enables him to

resist fresh attacks, under circumstances similar to those which before engendered them.

Natives of the low country, and especially Bengalees, are far from enjoying the climate as Europeans do, being liable to sharp attacks of fever and ague, from which the poorly clad natives are not exempt. It is, however, difficult to estimate the effects of exposure upon the Bengalees, who sleep on the bare and often damp ground, and adhere, with characteristic prejudice, to the attire of a torrid climate, and to a vegetable diet, under skies to which these are least of all adapted.

It must not be supposed that Europeans who have resided in plains can, on their first arrival, expose themselves with impunity to the cold of these elevations; this was shown in the winter of 1848 and 1849, when troops brought up to Darjeeling were cantoned in newly-built dwellings, on a high exposed ridge 8,000 feet above the sea, and lay, insufficiently protected, on a floor of loosely laid planks, exposed to the cold wind, when the ground without was covered with snow. Rheumatisms, sharp febrile attacks, and dysenteries ensued, which were attributed in the public prints to the unhealthy nature of the climate of Darjeeling.

The following summary of hospital admissions affords the best test of the healthiness of the climate, embracing, as the period does, the three most fatal months to European troops in India. Out of a detachment (105 strong) of H. M. 80th Regiment stationed at Darjeeling, in the seven months from January to July inclusive, there were sixty-four admissions to the hospital, or, on the average, 4⅘ per cent. per month; and only two deaths, both of dysentery. Many of these men had suffered frequently in the plains from acute dysentery and hepatic affections, and many others had aggravated these complaints by excessive drinking, and two were cases of delirium tremens. During the same period, the number of entries at Calcutta or Dinapore would probably have more than trebled this.

CHAPTER V.

View from Mr. Hodgson's of range of snowy mountains—Their extent and elevation—Delusive appearance of elevation—Sinchul, view from and vegetation of—Chumulari—Magnolias, white and purple—Rhododendron Dalhousiæ, arboreum and argenteum—Natives of Darjeeling—Lepchas, origin, tradition of flood, morals, dress, arms, ornaments, diet—cups, origin and value—Marriages—Diseases—Burial—Worship and religion—Bijooas—Kampa Rong, or Arratt—Limboos, origin, habits, language, &c.—Moormis—Magras—Mechis—Comparison of customs with those of the natives of Assam, Khasia, &c.

THE summer, or rainy season of 1848, was passed at or near Darjeeling, during which period I chiefly occupied myself in forming collections, and in taking meteorological observations. I resided at Mr. Hodgson's for the greater part of the time, in consequence of his having given me a hospitable invitation to consider his house my home. The view from his windows is one quite unparalleled for the scenery it embraces, commanding confessedly the grandest known landscape of snowy mountains in the Himalaya, and hence in the world.[1] Kinchinjunga (forty-five miles distant) is the prominent object, rising 21,000 feet above the level of the observer out of a sea of intervening wooded hills; whilst, on a line with its snows, the eye descends below the horizon, to a narrow gulf 7,000 feet deep in the mountains, where the Great Rungeet, white with foam, threads a tropical forest with a silver line.

To the north-west towards Nepal, the snowy peaks of Kubra and Junnoo (respectively 24,005 feet and 25,312 feet) rise over the shoulder of Singalelah; whilst eastward the snowy mountains appear to form an unbroken range, trending north-east to the great mass of Donkia (23,176 feet) and thence south-east by the fingered peaks of Tunkola and the silver cone of Chola (17,320 feet), gradually sinking into the Bhotan mountains at Gipmoochi (14,509 feet).

The most eloquent descriptions I have read fail to convey to my mind's eye the forms and colours of snowy mountains, or to my imagination the sensations and impressions that rivet my attention to these sublime phenomena when they are present in reality; and I shall not therefore obtrude any attempt of the kind upon my reader. The latter has probably seen the Swiss Alps, which, though barely possessing half the sublimity, extent, or height of the Himalaya, are yet far more beautiful. In either

[1] For an account of the geography of those regions, and the relation of the Sikkim Himalaya to Tibet, &c., see Appendix.

case he is struck with the precision and sharpness of their outlines, and still more with the wonderful play of colours on their snowy flanks, from the glowing hues reflected in orange, gold and ruby, from clouds illumined by the sinking or rising sun, to the ghastly pallor that succeeds with twilight, when the red seems to give place to its complementary colour green. Such dissolving-views elude all attempts at description, they are far too aërial to be chained to the memory, and fade from it so fast as to be gazed upon day after day, with undiminished admiration and pleasure, long after the mountains themselves have lost their sublimity and apparent height.

The actual extent of the snowy range seen from Mr. Hodgson's windows is comprised within an arc of 80° (from north 30° west to north 50° east), or nearly a quarter of the horizon, along which the perpetual snow forms an unbroken girdle or crest of frosted silver; and in winter, when the mountains are covered down to 8,000 feet, this white ridge stretches uninterruptedly for more than 160°. No known view is to be compared with this in extent, when the proximity and height of the mountains are considered; for within the 80° above mentioned more than twelve peaks rise above 20,000 feet, and there are none below 15,000 feet, while Kinchin is 28,178, and seven others above 22,000. The nearest perpetual snow is on Nursing, a beautifully sharp conical peak 19,139 feet high, and thirty-two miles distant; the most remote mountain seen is Donkia, 23,176 feet high, and seventy-three miles distant; whilst Kinchin, which forms the principal mass both for height and bulk, is exactly forty-five miles distant.

On first viewing this glorious panorama, the impression produced on the imagination by their prodigious elevation is, that the peaks tower in the air and pierce the clouds, and such are the terms generally used in descriptions of similar alpine scenery; but the observer, if he look again, will find that even the most stupendous occupy a very low position on the horizon, the top of Kinchin itself measuring only 4° 31′ above the level of the observer! Donkia again, which is 23,176 feet above the sea, or about 15,700 above Mr. Hodgson's, rises only 1° 55′ above the horizon; an angle which is quite inappreciable to the eye, when unaided by instruments.[1]

This view may be extended a little by ascending Sinchul, which

[1] These are the apparent angles which I took from Mr. Hodgson's house (alt. 7,300 feet) with an excellent theodolite, no deduction being made for refraction.

rises a thousand feet above the elevation of Mr. Hodgson's house, and is a few miles south-east of Darjeeling: from its summit Chumulari (23,929 feet) is seen to the north-east, at eighty-four miles distance, rearing its head as a great rounded mass over the snowy Chola range, out of which it appears to rise, although in reality lying forty miles beyond;—so deceptive is the perspective of snowy mountains. To the north-west again, at upwards of 100 miles distance, a beautiful group of snowy mountains rises above the black Singalelah range, the chief being, perhaps, as high as Kinchinjunga, from which it is fully eighty miles distant to the westward; and between them no mountain of considerable altitude intervenes; the Nepalese Himalaya in that direction sinking remarkably towards the Arun river, which there enters Nepal from Tibet.

The top of Sinchul is a favourite excursion from Darjeeling, being very easy of access, and the path abounding in rare and beautiful plants, and passing through magnificent forests of oak, magnolia, and rhododendron; while the summit, besides embracing this splendid view of the snowy range over the Darjeeling spur in the foreground, commands also the plains of India, with the courses of the Teesta, Mahanuddee, Balasun and Mechi rivers. In the months of April and May, when the magnolias and rhododendrons are in blossom, the gorgeous vegetation is, in some respects, not to be surpassed by anything in the tropics; but the effect is much marred by the prevailing gloom of the weather. The white-flowered magnolia (*M. excelsa*, Wall,) forms a predominant tree at 7,000 to 8,000 feet; and in 1848 it blossomed so profusely, that the forests on the broad flanks of Sinchul, and other mountains of that elevation, appeared as if sprinkled with snow. The purple-flowered kind again (*M. Campbellii*) hardly occurs below 8,000 feet, and forms an immense, but very ugly, black-barked, sparingly branched tree, leafless in winter and also during the flowering season, when it puts forth from the ends of its branches great rose-purple cup-shaped flowers, whose fleshy petals strew the ground. On its branches, and on those of oaks and laurels, *Rhododendron Dalhousiæ* grows epiphytically, a slender shrub, bearing from three to six white lemon-scented bells, four and a half inches long and as many broad, at the end of each branch. In the same woods the scarlet rhododendron (*R. arboreum*) is very scarce, and is outvied by the great *R. argenteum*, which grows as a tree forty feet high, with magnificent leaves twelve to fifteen inches long, deep green, wrinkled above and silvery below, while

the flowers are as large as those of *R. Dalhousiæ*, and grow more in a cluster. I know nothing of the kind that exceeds in beauty the flowering branch of *R. argenteum*, with its wide spreading foliage and glorious mass of flowers.

Oaks, laurels, maples, birch, chesnut, hydrangea, a species of fig (which is found on the very summit), and three Chinese and Japanese genera, are the principal features of the forest; the common bushes being *Aucuba*, *Skimmia*, and the curious *Helwingia*, which bears little clusters of flowers on the centre of the leaf, like butcher's-broom. In spring immense broad-leaved arums spring up, with green or purple-striped hoods, that end in tail-like threads, eighteen inches long, which lie along the ground; and there are various kinds of *Convallaria*, *Paris*, *Begonia*, and other beautiful flowering herbs. Nearly thirty ferns may be gathered on this excursion, including many of great beauty and rarity, but the tree-fern does not ascend so high. Grasses are very rare in these woods, excepting the dwarf bamboo, now cultivated in the open air in England.

Before proceeding to narrate my different expeditions into Sikkim and Nepal from Darjeeling, I shall give a sketch of the different peoples and races composing the heterogeneous population of Sikkim and the neighbouring mountains.

The Lepcha is the aboriginal inhabitant of Sikkim, and the prominent character in Darjeeling, where he undertakes all sorts of out-door employment. The race to which he belongs is a very singular one; markedly Mongolian in features, and a good deal too, by imitation, in habit; still he differs from his Tibetan prototype, though not so decidedly as from the Nepalese and Bhotanese, between whom he is hemmed into a narrow tract of mountain country, barely 60 miles in breadth. The Lepchas possess a tradition of the flood, during which a couple escaped to the top of a mountain (Tendong) near Darjeeling. The earliest traditions which they have of their history date no further back than some three hundred years, when they describe themselves as having been long-haired, half-clad savages. At about that period they were visited by Tibetans, who introduced Boodh worship, the platting of their hair into pig-tails, and very many of their own customs. Their physiognomy is however so Tibetan in its character, that it cannot be supposed that this was their earliest intercourse with the trans-nivean races: whether they may have wandered from beyond the snows before the spread of Boodhism and its civilisation, or whether they are a cross between the Tamulian of India and the Tibetan, has not been decided.

Their language, though radically identical with Tibetan, differs from it in many important particulars. They, or at least some of their tribes, call themselves Rong, and Arratt, and their country Dijong: they once possessed a great part of East Nepal, as far west as the Tambur river, and at a still earlier period they penetrated as far west as the Arun river.

LEPCHA GIRL AND BHOODIST LAMA.

An attentive examination of the Lepcha in one respect entirely contradicts our preconceived notions of a mountaineer, as he is timid, peaceful, and no brawler; qualities which are all the more remarkable from contrasting so strongly with those of his neighbours to the east and west: of whom the Ghorkas are brave and warlike to a proverb, and the Bhotanese quarrelsome,

cowardly, and cruel. A group of Lepchas is exceedingly picturesque. They are of short stature—four feet eight inches to five feet—rather broad in the chest, and with muscular arms, but small hands and slender wrists.[1] The face is broad, flat, and of eminently Tartar character, flat-nosed and oblique-eyed, with no beard, and little moustache; the complexion is sallow, or often a clear olive; the hair is collected into an immense tail, plaited flat or round. The lower limbs are powerfully developed, befitting genuine mountaineers: the feet are small. Though never really handsome, and very womanish in the cast of countenance, they have invariably a mild, frank, and even engaging expression, which I have in vain sought to analyse, and which is perhaps due more to the absence of anything unpleasing, than to the presence of direct grace or beauty. In like manner, the girls are often very engaging to look upon, though without one good feature: they are all smiles and good-nature; and the children are frank, lively, laughing urchins. The old women are thorough hags. Indolence, when left to themselves, is their besetting sin; they detest any fixed employment, and their foulness of person and garments renders them disagreeable inmates: in this rainy climate they are supportable out of doors. Though fond of bathing when they come to a stream in hot weather, and expert, even admirable swimmers, these people never take to the water for the purpose of ablution. In disposition they are amiable and obliging, frank, humorous, and polite, without the servility of the Hindoos; and their address is free and unconstrained. Their intercourse with one another and with Europeans is scrupulously honest; a present is divided equally amongst many, without a syllable of discontent or grudging look or word: each, on receiving his share, coming up and giving the donor a brusque bow and thanks. They have learnt to overcharge already, and use extortion in dealing, as is the custom with the people of the plains; but it is clumsily done, and never accompanied with the grasping air and insufferable whine of the latter. They are constantly armed with a long, heavy, straight knife,[2] but never draw it on one another: family and political feuds are alike unheard of amongst them.

[1] I have seldom been able to insert my own wrist (which is smaller than the average) into the wooden guard which the Lepcha wears on his left, as a protection against the bow-string: it is a curved ring of wood with an opening at one side, through which, by a little stretching, the wrist is inserted.

[2] It is called "Ban," and serves equally for plough, toothpick, table-knife, hatchet, hammer, and sword.

The Lepcha is in morals far superior to his Tibet and Bhotan neighbours, polyandry being unknown, and polygamy rare. This is no doubt greatly due to the conventual system not being carried to such an excess as in Bhotan, where the ties of relationship even are disregarded.

Like the New Zealander, Tasmanian, Fuegian, and natives of other climates, which, though cold, are moist and equable, the Lepcha's dress is very scanty, and when we are wearing woollen under-garments and hose, he is content with one cotton vesture, which is loosely thrown round the body, leaving one or both arms free; it reaches to the knee, and is gathered round the waist: its fabric is close, the ground colour white, ornamented with longitudinal blue stripes, two or three fingers broad, prettily worked with red and white. When new and clean, this garb is remarkably handsome and gay, but not showy. In cold weather an upper garment with loose sleeves is added. A long knife, with a common wooden handle, hangs by the side, stuck in a sheath; he has often also a quiver of poisoned arrows and a bamboo[1] bow across his back. On his right wrist is a curious wooden guard for the bowstring; and a little pouch, containing aconite poison and a few common implements, is suspended to his girdle. A hat he seldom wears, and when he does, it is often extravagantly broad and flat-brimmed, with a small hemispherical crown. It is made of leaves of *Scitamineæ*, between two thin plates of bamboo-work, clumsy and heavy; this is generally used in the rainy weather, while in the dry a conical one is worn, also of platted slips of bamboo, with broad flakes of talc between the layers, and a peacock's feather at the side. The umbrella consists of a large hood, much like the ancient boat called a coracle, which being placed over the head reaches to the thighs behind. It is made of platted bamboo, enclosing broad leaves of *Phrynium*. A group of Lepchas with these on, running along in the pelting rain, are very droll figures; they look like snails with their shells on their backs. All the Lepchas are fond of ornaments, wearing silver hoops in their ears, necklaces made of cornelian, amber, and turquoise, brought from Tibet, and pearls and corals from the south, with curious silver and golden charm-boxes or amulets attached to their necks or arms. These are of Tibetan workmanship, and often of great value: they contain little idols, charms, and written prayers, or the bones, hair, or nail-parings

[1] The bamboo, of which the quiver is made, is thin and light: it is brought from Assam, and called Tulda, or Dulwa, by the Bengalees.

of a Lama: some are of great beauty, and highly ornamented. In these decorations, and in their hair, they take some pride, the ladies frequently dressing the latter for the gentlemen: thus one may often see, the last thing at night, a damsel of discreet port, demurely go behind a young man, unplait his pig-tail, teaze the hair, thin it of some of its lively inmates, braid it up for him, and retire. The women always wear two braided pig-tails, and it is by this they are most readily distinguished from their effeminate-looking partners, who wear only one.[1] When in full dress, the woman's costume is extremely ornamental and picturesque; besides the shirt and petticoat she wears a small sleeveless woollen cloak, of gay pattern, usually covered with crosses, and fastened in front by a girdle of silver chains. Her neck is loaded with silver chains, amber necklaces, &c., and her head adorned with a coronet of scarlet cloth, studded with seed-pearls, jewels, glass beads, &c. The common dress is a long robe of indi, a cloth of coarse silk, spun from the cocoon of a large caterpillar that is found wild at the foot of the hills, and is also cultivated: it feeds on many different leaves, Sal (*Shorea*), castor-oil, &c.

In diet, they are gross feeders;[2] rice, however, forming their chief sustenance; it is grown without irrigation, and produces a large, flat, coarse grain, which becomes gelatinous, and often pink, when cooked. Pork is a staple dish: and they also eat elephant, and all kinds of animal food. When travelling, they live on whatever they can find, whether animal or vegetable. Fern-tops, roots of *Scitamineæ*, and their flower-buds, various leaves (it is difficult to say what not), and fungi, are chopped up, fried with a little oil, and eaten. The cooking is coarse and dirty. Salt is costly, but prized; pawn (Betel pepper) is never eaten. Tobacco they are too poor to buy, and too indolent to grow and cure. Spices, oil, &c., are relished.

They drink out of little wooden cups, turned from knots of maple or other woods; these are very curious on several accounts; they are very pretty, often polished, and mounted with silver. Some are supposed to be antidotes against poison, and hence fetch an enormous price; they are of a peculiar wood,

[1] Ermann (Travels in Siberia, ii. p. 204) mentions the Buraet women as wearing two tails, and fillets with jewels, and the men as having one queue only.

[2] Dr. Campbell's definition of the Lepcha's *Flora cibaria*, is, that he eats, or must have eaten, everything soft enough to chew; for, as he knows whatever is poisonous, he must have tried all; his knowledge being wholly empirical.

rarer and paler-coloured. I have paid a guinea for one such, hardly different from the common sort, which cost but 4d. or 6d. MM. Huc and Gabet graphically allude to this circumstance, when wishing to purchase cups at Lhassa, where their price is higher, as they are all imported from the Himalaya. The knots from which they are formed are produced on the roots of oaks, maples, and other mountain forest trees, by a parasitical plant known to botanists as *Balanophora*.

Their intoxicating drink, which seems more to excite than to debauch the mind, is partially fermented Murwa grain (*Eleusine Coracana*). Spirits are rather too strong to be relished raw, and when a glass of wine is given to one of a party, he sips it, and hands it round to all the rest. A long bamboo flute, with four or six burnt holes far below the mouth-hole, is the only musical instrument I have seen in use among them. When travelling, and the fatigues of the day are over, the Lepchas will sit for hours chatting, telling stories, singing in a monotonous tone, or blowing this flute. I have often listened with real pleasure to the simple music of this rude instrument; its low and sweet tones are singularly Æolian, as are the airs usually played, which fall by octaves: it seems to harmonise with the solitude of their primæval forests, and he must have a dull ear who cannot draw from it the indication of a contented mind, whether he may relish its soft musical notes or not. Though always equipped for the chase, I fancy the Lepcha is no great sportsman; there is little to be pursued in this region, and he is not driven by necessity to follow what there is.

Their marriages are contracted in childhood, and the wife purchased by money, or by service rendered to the future father-in-law, the parties being often united before the woman leaves her parents' roof, in cases where the payment is not forthcoming, and the bridegroom prefers giving his and his wife's labour to the father for a stated period in lieu. On the time of service expiring, or the money being paid up, the marriage is publicly celebrated by feasting and riot. The females are generally chaste, and the marriage-tie is strictly kept, its violation being heavily punished by divorce, beating, slavery, &c. In cases of intermarriage with foreigners, the children belong to the father's country. All the labours of the house, the field, and march devolve on the women and children, or slaves if they have them.

Small-pox is dreaded, and infected persons often cruelly shunned: a suspicion of this or of cholera frequently emptying a village or town in a night. Vaccination has been introduced

by Dr. Pearson, and it is much practised by Dr. Campbell; it being eagerly sought. Cholera is scarcely known at Darjeeling, and when it has been imported thither has never spread. Disease is very rare amongst the Lepchas; and ophthalmia, elephantiasis, and leprosy, the scourges of hot climates, are rarely known. Goître prevails,[1] though not so conspicuously as amongst Bhoteeas, Bhotanese, and others. Rheumatism is frequent, and intermittent fevers, with ague; also violent and often fatal remittents, almost invariably induced by sleeping in the hot valleys, especially at the beginning and end of the rains. The European complaints of liver and bowel disease are all but unknown. Death is regarded with horror. The dead are burnt or buried, sometimes both; much depending on custom and position. Omens are sought in the entrails of fowls, &c., and other vestiges of their savage origin are still preserved, though now gradually disappearing.

The Lepchas profess no religion, though acknowledging the existence of good and bad spirits. To the good they pay no heed; "Why should we?" they say, "the good spirits do us no harm; the evil spirits, who dwell in every rock, grove, or mountain, are constantly at mischief, and to them we must pray, for they hurt us." Every tribe has a priest-doctor; he neither knows nor attempts to practise the healing art, but is a pure exorcist; all bodily ailments being deemed the operations of devils, who are cast out by prayers and invocations. Still they acknowledge the Lamas to be very holy men, and were the latter only moderately active, they would soon convert all the Lepchas. Their priests are called "Bijooas:" they profess mendicancy, and seem intermediate between the begging friars of Tibet, whose dress and attributes they assume, and the exorcists of the aboriginal

[1] May not the use of the head instead of the shoulder-strap in carrying loads be a predisposing cause of goître, by inducing congestion of the laryngeal vessels? The Lepcha is certainly far more free from this disease than any of the tribes of E. Nepal I have mixed with, and he is both more idle and less addicted to the head-strap as a porter. I have seen it to be almost universal in some villages of Bhoteeas, where the head-strap alone is used in both summer and winter crops; as also amongst the salt-traders, or rather those families who carry the salt from the passes to the Nepalese villages, and who very frequently have no shoulder-straps, but invariably head-bands. I am far from attributing all goître, even in the mountains, to this practice, but I think it is proved, that the disease is most prevalent in the mountainous regions of both the old and new world, and that in these the practice of supporting enormous loads by the cervical muscles is frequent. It is also found in the Himalayan sheep and goats which accompany the salt-traders, and whose loads are supported in ascending by a band passing under the throat.

Lepchas: they sing, dance (masked and draped like harlequins), beg, bless, curse, and are merry mountebanks; those that affect more of the Lama Boodhist carry the "Mani," or revolving praying machine, and wear rosaries and amulets; others again are all tatters and rags. They are often employed to carry messages, and to transact little knaveries. The natives stand in some awe of them, and being besides of a generous disposition, keep the wallet of the Bijooa always full.

Such are some of the prominent features of this people, who inhabit the sub-Himalayas, between the Nepalese and Bhotan frontiers, at elevations of 3,000 to 6,000 feet. In their relations with us, they are conspicuous for their honesty, their power as carriers and mountaineers, and their skill as woodsmen; for they build a waterproof house with a thatch of banana leaves in the lower, or of bamboo in the elevated regions, and equip it with a table and bedsteads for three persons, in an hour, using no implement but their heavy knife. Kindness and good humour soon attach them to your person and service. A gloomy-tempered or morose master they avoid, an unkind one they flee. If they serve a good hillsman like themselves, they will follow him with alacrity, sleep on the cold, bleak mountain exposed to the pitiless rain, without a murmur, lay down the heavy burden to carry their master over a stream, or give him a helping hand up a rock or precipice—do anything, in short, but encounter a foe, for I believe the Lepcha to be a veritable coward.[1] It is well, perhaps, he is so: for if a race, numerically so weak, were to embroil itself by resenting the injuries of the warlike Ghorkas, or dark Bhotanese, the folly would soon lead to destruction.

Before leaving the Lepchas, it may be worth mentioning that the northern parts of the country, towards the Tibet frontier, are inhabited by Sikkim Bhoteeas[2] (or Kumpas), a mixed race calling

[1] Yet, during the Ghorka war, they displayed many instances of courage: when so hard pressed, however, that there was little choice of evils.

[2] Bhote is the general name for Tibet (not Bhotan), and Kumpa is a large province, or district, in that country. The Bhotanese, natives of Bhotan, or of the Dhurma country, are called Dhurma people, in allusion to their spiritual chief, the Dhurma Rajah. They are a darker and more powerful race, rude, turbulent, and Tibetan in language and religion, with the worst features of those people exaggerated. The various races of Nepal are too numerous to be alluded to here: they are described in various papers by Mr. Hodgson, in the "Journal of the Asiatic Society of Bengal." The Dhurma people are numerous at Darjeeling; they are often runaways, but invariably prove more industrious settlers than the Lepchas. In the Himalaya the name Bhotan is unknown amongst the Tibetans; it signifies literally (according to Mr. Hodgson) the end of Bhote, or Tibet, being the eastern extreme of that

themselves Kumpa Rong, or Kumpa Lepchas; but they are emigrants from Tibet, having come with the first rajah of Sikkim. These people are much more turbulent and bolder than the Lepchas, and retain much of their Tibetan character, and even of that of the very province from which they came; which is north-east of Lhassa, and inhabited by robbers. All the accounts I have received of it agree with those given by MM. Huc and Gabet.

Next to the Lepchas, the most numerous tribe in Sikkim is that of the Limboos (called "Chung" by the Lepchas); they abound also in East Nepal, which they once ruled, inhabiting elevations from 2,000 feet to 5,000 feet. They are Boodhists, and though not divided into castes, belong to several tribes. All consider themselves as the earliest inhabitants of the Tambur Valley, though they have a tradition of having originally emigrated from Tibet, which their Tartar countenance confirms. They are more slender and sinewy than the Lepchas, and neither plait their hair nor wear ornaments; instead of the ban they use the Nepal curved knife, called "cookree," while for the striped kirtle of the Lepcha are substituted loose cotton trousers and a tight jacket; a sash is worn round the middle, and on the head a small cotton cap. When they ruled over East Nepal, their system was feudal; and on their uniting against the Nepalese, they were with difficulty dislodged from their strongholds. They are said to be equally brave and cruel in battle, putting the old and weak to the sword, carrying the younger to slavery, and killing on the march such captives as are unable to proceed. Many enlist at Darjeeling, which the Lepchas never do; and the rajah of Nepal employs them in his army, where, however, they seldom obtain promotion, this being reserved for soldiers of Hindoo tribes. Latterly Jung Bahadur levied a force of 6,000 of them, who were cantoned at Katmandoo, where the cholera breaking out, carried off some hundreds, causing many families who dreaded conscription to flock to Darjeeling. Their habits are so similar to those of the Lepchas, that they constantly intermarry. They mourn, burn, and bury their dead, raising a mound over the corpse, erecting a headstone, and surrounding the grave with a little paling of sticks; they then scatter eggs and pebbles over the ground. In these offices the Bijooa of the Lepchas is employed, but the Limboo has also priests of his own, called

country. The Lepchas designate Bhotan as Ayeu, or Aieu, as do often the Bhotanese themselves. Sikkim, again, is called Lhop, or Lho', by the Lepchas and Bhotanese.

"Phedangbos," who belong to rather a higher order than the Bijooas. They officiate at marriages, when a cock is put into the bridegroom's hands, and a hen into those of the bride; the Phedangbo then cuts off the birds' heads, when the blood is caught on a plantain leaf, and runs into pools from which omens are drawn. At death, guns are fired, to announce to the gods the departure of the spirit; of these there are many, having one supreme head, and to them offerings and sacrifices are made. They do not believe in metempsychosis.

The Limboo language is totally different from the Lepcha, with less of the *z* in it, and more labials and palatals, hence more pleasing. Its affinities I do not know; it has no peculiar written character, the Lepcha or Nagri being used. Dr. Campbell, from whom I have derived most of my information respecting these people, was informed,[1] on good authority, that they had once a written language, now lost; and that it was compounded from many others by a sage of antiquity. The same authority stated that their Lepcha name "Chung" is a corruption of that of their place of residence; possibly the "Tsang" province of Tibet.

The Moormis are the only other native tribe remaining in any numbers in Sikkim, except the Tibetans of the loftier mountains (whom I shall mention at a future period), and the Mechis of the pestilential Terai, the forests of which they never leave. The Moormis are a scattered people, respecting whom I have no information, except from the authority quoted above. They are of Tibetan origin, and called "Nishung," from being composed of two branches, respectively from the districts of Nimo and Shung, both on the road between Sikkim and Lhassa. They are now most frequent in central and eastern Nepal, and are a pastoral and agricultural people, inhabiting elevations of 4,000 to 6,000 feet, and living in stone houses, thatched with grass. They are a large, powerful, and active race, grave, very plain in features, with little hair on the face. Both their language and religion are purely Tibetan.

The Magras, a tribe now confined to Nepal west of the Arun, are aborigines of Sikkim, whence they were driven by the Lepchas westward into the country of the Limboos, and by these latter further west still. They are said to have been savages, and not of Tibetan origin, and are now converted to Hindooism. A somewhat mythical account of a wild people still inhabiting the Sikkim mountains, will be alluded to elsewhere.

[1] See "Darjeeling Guide," p. 89. Calcutta, 1854.

It is curious to observe that these mountains do not appear to have afforded refuge to the Tamulian [1] aborigines of India proper; all the Himalayan tribes of Sikkim being markedly Mongolian in origin. It does not, however, follow that they are all of Tibetan extraction: perhaps, indeed, none but the Moormis are so. The Mechi of the Terai is decidedly Indo-Chinese, and of the same stock as the savage races of Assam, the north-east and east frontier of Bengal, Arracan, Burmah, &c. Both Lepchas and Limboos had, before the introduction of Lama Boodhism from Tibet, many features in common with the natives of Arracan, especially in their creed, sacrifices, faith in omens, worship of many spirits, absence of idols, and of the doctrine of metempsychosis. Some of their customs, too, are the same; the form of their houses and of some of their implements, their striped garments, their constant and dexterous use of the bamboo for all utensils, their practice of night-attacks in war, of using poisoned arrows only in the chase, and that of planting "crowfeet" of sharp bamboo stakes along the paths an enemy is expected to follow. Such are but a few out of many points of resemblance, most of which struck me when reading Lieutenant Phayre's account of Arracan,[2] and when travelling in the districts of Khasia and Cachar.

The laws affecting the distribution of plants, and the lower animals, materially influence the migrations of man also; and as the botany, zoology, and climate of the Malayan and Siamese peninsula advance far westwards into India, along the foot of the Himalaya, so do also the varieties of the human race. These features are most conspicuously displayed in the natives of Assam, on both sides of the Burrampooter, as far as the great bend of that river, beyond which they gradually disappear; and none of the Himalayan tribes east of that point practise the bloody and brutal rites in war that prevail amongst the Cookies, Khasias, Garrows, and other Indo-Chinese tribes of the mountain forests of Assam, Eastern Bengal, and the Malay peninsula.

I have not alluded to that evidence of the extraction of the Sikkim races which is to be derived from their languages, and from which we may hope for a clue to their origin; the subject is at present under discussion, and involved in much obscurity.

[1] The Tamulians are the Coles, Dangas, &c., of the mountains of Central India and the peninsula, who retired to mountain fastnesses, on the invasion of their country by the Indo-Germanic conquerors, who are now represented by the Hindoos.

[2] "Journal of the Asiatic Society of Bengal."

That six or seven different tribes, without any feudal system or coercive head, with different languages and customs, should dwell in close proximity and in peace and unity, within the confined territory of Sikkim, even for a limited period, is an anomaly; the more especially when it is considered that except for a tincture of the Boodhist religion among some few people, they are all but savages, as low in the scale of intellect as the New Zealander or the Tahitian, and beneath those races in ingenuity and skill as craftsmen. Wars have been waged amongst them, but they were neither sanguinary nor destructive, and the fact remains no less remarkable, that at the period of our occupying Darjeeling, friendship and unanimity existed amongst all these tribes; from the Tibetan at 14,000 feet, to the Mechi of the plains; under a sovereign whose temporal power was wholly unsupported by even the semblance of arms, and whose spiritual supremacy was acknowledged by very few.

CHAPTER VI.

Excursion from Darjeeling to Great Rungeet—Zones of vegetation—Tree-ferns—Palms, upper limit of—Leebong, tea plantations—Ging—Boodhist remains—Tropical vegetation—Pines—Lepcha clearances—Forest fires—Boodhist monuments—Fig—Cane bridge and raft over Rungeet—Sago-palm—India-rubber—Yel Pote—Butterflies and other insects—Snakes—Camp—Temperature and humidity of atmosphere—Junction of Teesta and Rungeet—Return to Darjeeling—Tonglo, excursion to—Bamboo flowering—Oaks—Gordonia—Maize, hermaphrodite flowered—Figs—Nettles—Peepsa—Simonbong, cultivation at—European fruits at Darjeeling—Plains of India.

A VERY favourite and interesting excursion from Darjeeling is to the cane bridge over the Great Rungeet river, 6,000 feet below the station. To this an excellent road has been cut, by which the whole descent of six miles, as the crow flies, is easily performed on pony-back; the road distance being only eleven miles. The scenery is, of course, of a totally different description from that of Sinchul, or even of the foot of the hills, being that of a deep mountain-valley. I several times made this trip: on the excursion about to be described, and in which I was accompanied by Mr. Barnes, I followed the Great Rungeet to the Teesta, into which it flows.

In descending from Darjeeling, the zones of vegetation are well marked between 6,000 and 7,000 feet by—1. The oak,

chesnut, and Magnolias, the main features from 7,000 to 10,000 feet.—2. Immediately below 6,500 feet, the tree-fern appears (*Alsophila gigantea*, Wall.), a widely-distributed plant, common to the Himalaya, from Nepal eastward to the Malayan peninsula, Java, and Ceylon.—3. Of palms, a species of *Calamus*, and *Plectocomia*, the "Rhenoul" of the Lepchas. The latter, though not a very large plant, climbs lofty trees, and extends about forty yards through the forest; 6,500 feet is the upper limit of palms in the Sikkim Himalaya, the Rhenoul alone attaining this elevation.[1]—4. The fourth striking feature is a wild plaintain, which ascends to nearly the same elevation ("Lukhlo," Lepcha). This is replaced by another, and rather larger species, at lower elevations; both ripen austere and small fruits, which are full of seeds, and quite uneatable; that commonly grown in Sikkim is an introduced stock (nor have the wild species ever been cultivated); it is very large, but poor in flavour, and does not bear seeds. The zones of these conspicuous plants are very clearly defined, and especially if the traveller, standing on one of the innumerable spurs which project from the Darjeeling ridge, cast his eyes up the gorges of green on either hand.

At 1,000 feet below Darjeeling a fine wooded spur projects, called Leebong. This beautiful spot is fully ten degrees warmer than Mr. Hodgson's house, and enjoys considerably more sunshine; peaches and English fruit-trees flourish extremely well, but do not ripen fruit. The tea-plant succeeds here admirably, and might be cultivated to great profit, and be of advantage in furthering a trade with Tibet. It has been tried on a large scale by Dr. Campbell at his residence (alt. 7,000 feet), but the frosts and snow of that height injure it, as do the hailstorms in spring.

Below Leebong is the village of Ging, surrounded by steeps, cultivated with maize, rice, and millet. It is rendered very

[1] Four other *Calami* range between 1,000 and 6,000 feet on the outer hills, some of them being found forty miles distant from the plains of India. The other palms of Sikkim are, "Simong" (*Caryota urens*); it is rare, and ascends to nearly 5,000 feet. *Phœnix* (probably *P. acaulis*, Buch.), a small, stemless species, which grows on the driest soil in the deep valleys; it is the "Schaap" of the Lepchas, who eat the young seeds, and use the feathery fronds as screens in hunting. *Wallichia oblongifolia*, the "Ooh" of the Lepchas, who make no use of it; Dr. Campbell and myself, however, found that it is an admirable fodder for horses, who prefer it to any other green food to be had in these mountains. *Areca gracilis* and *Licuala peltata* are the only other palms in Sikkim; but *Cycas pectinata*, with the India-rubber fig, occurs in the deepest and hottest valleys—the western limit of both these interesting plants. Of *Pandanus* there is a graceful species at elevations of 1,000 to 4,000 feet ("Borr," Lepcha).

picturesque by a long row of tall poles, each bearing a narrow, vertically elongated banner, covered with Boodhist inscriptions, and surmounted by coronet-like ornaments, or spear-heads, rudely cut out of wood, or formed of basket-work, and adorned with cotton fringe. Ging is peopled by Bhotan emigrants, and when one dies, if his relations can afford to pay for them, two additional poles and flags are set up by the Lamas in honour of his memory, and that of Sunga, the third member of the Boodhist Trinity.

Below this the *Gordonia* commences, with *Cedrela toona*, and various tropical genera, such as abound near Punkabaree. The heat and hardness of the rocks cause the streams to dry up on these abrupt hills, especially on the eastern slope, and the water is therefore conveyed along the sides of the path, in conduits ingeniously made of bamboo, either split in half, or, what is better, whole, except at the septum, which is removed through a lateral hole. The oak and chesnut of this level (3,000 feet) are both different from those which grow above, as are the brambles. The *Arums* are replaced by *Caladiums*. Tree-ferns cease below 4,000 feet, and the large bamboo abounds.

At about 2,000 feet, and ten miles distant from Darjeeling, we arrived at a low, long spur, dipping down to the bed of the Rungeet, at its junction with the Rungmo. This is close to the boundary of the British ground, and there is a guard-house, and a sepoy or two at it; here we halted. It took the Lepchas about twenty minutes to construct a table and two bedsteads within our tent; each was made of four forked sticks, stuck in the ground, supporting as many side-pieces, across which were laid flat split pieces of bamboo, bound tightly together by strips of rattan palm-stem. The beds were afterwards softened by many layers of bamboo-leaf, and if not very downy, they were dry, and as firm as if put together with screws and joints.

This spur rises out of a deep valley, quite surrounded by lofty mountains; it is narrow, and covered with red clay, which the natives chew as a cure for goître. North, it looks down into a gully, at the bottom of which the Rungeet's foamy stream winds through a dense forest. In the opposite direction, the Rungmo comes tearing down from the top of Sinchul, 7,000 feet above; and though its roar is heard, and its course is visible throughout its length, the stream itself is nowhere seen, so deep does it cut its channel. Except on this, and a few similarly hard rocky hills around, the vegetation is a mass of wood and jungle. At this spot it is rather scanty and dry, with abundance of the *Pinus*

longifolia and Sal. The dwarf date-palm (*Phœnix acaulis*) also was very abundant.

The descent to the river was exceedingly steep, the banks presenting an impenetrable jungle. The pines on the arid crests of the hills around formed a remarkable feature: they grow like the Scotch fir, the tall, red trunks springing from the steep and dry slopes. But little resin exudes from the stem, which, like that of most pines, is singularly free from lichens and mosses; its wood is excellent, and the charcoal of the burnt leaves is used as a pigment. Being confined to dry soil, this pine is local in Sikkim, and the elevation it attains here is not above 3,000 feet. In Bhotan, where there is more dry country, its range is about the same, and in the north-west Himalaya, from 2,500 to 7,000 feet.

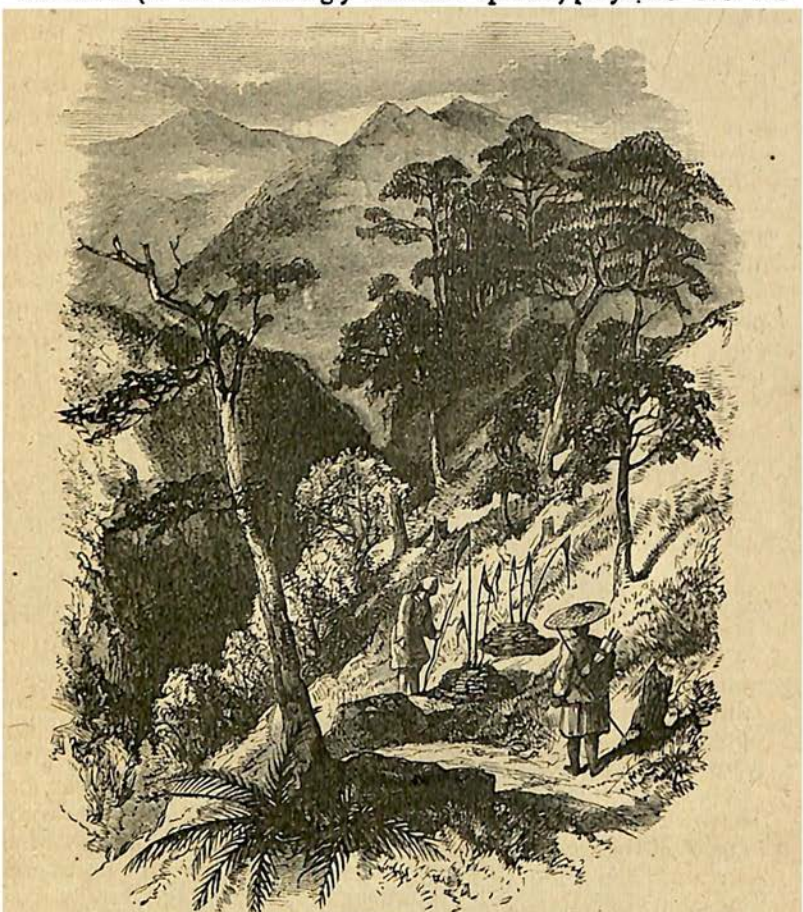
The Lepcha never inhabits one spot for more than three successive years, after which an increased rent is demanded by the Rajah. He therefore *squats* in any place which he can render profitable for that period, and then moves to another. His first operation, after selecting a site, is to burn the jungle; then he clears away the trees, and cultivates between the stumps. At this season, firing the jungle is a frequent practice, and the effect by night is exceedingly fine; a forest, so dry and full of bamboo, and extending over such steep hills, affording grand blazing spectacles. Heavy clouds canopy the mountains above, and, stretching across the valleys, shut out the firmament; the air is a dead calm, as usual in these deep gorges, and the fires, invisible by day, are seen raging all around, appearing to an inexperienced eye in all but dangerous proximity. The voices of birds and insects being hushed; nothing is audible but the harsh roar of the rivers, and occasionally, rising far above it, that of the forest fires. At night we were literally surrounded by them: some smouldering, like the shale-heaps at a colliery, others fitfully bursting forth, whilst others again stalked along with a steadily increasing and enlarging flame, shooting out great tongues of fire, which spared nothing as they advanced with irresistible might. Their triumph is in reaching a great bamboo clump, when the noise of the flames drowns that of the torrents, and as the great stem-joints burst, from the expansion of the confined air, the report is as that of a salvo from a park of artillery. At Darjeeling the blaze is visible, and the deadened reports of the bamboos bursting is heard throughout the night; but in the valley, and within a mile of the scene of destruction, the effect is the most grand, being heightened by the glare reflected from the masses of mist which hover above.

On the following morning we pursued a path to the bed of the

river; passing a rude Booddhist monument, a pile of slate-rocks, with an attempt at the mystical hemisphere at top. A few flags or banners, and slabs of slate, were inscribed with "Om Mani Padmi om." Placed on a jutting angle of the spur, backed with the pine-clad hills, and flanked by a torrent on either hand, the spot was wild and picturesque; and I could not but gaze with a feeling of deep interest on these emblems of a religion which perhaps numbers more votaries than any other on the face of the globe. Booddhism in some form is the predominating creed, from Siberia and Kamschatka to Ceylon, from the Caspian steppes to Japan, throughout China, Burmah, Ava, and a part of the Malayan Archipelago. Its associations enter into every book of travels over these vast regions, with Booddha, Dhurma, Sunga, Jos, Fo, and praying-wheels. The mind is arrested by the names, the imagination captivated by the symbols; and though I could not worship in the grove, it was impossible to deny to the inscribed stones such a tribute as is commanded by the first glimpse of objects which have long been familiar to our minds, but not previously offered to our senses. My head Lepcha went further: to a due observance of demon-worship he united a deep reverence for the Lamas, and he venerated their symbols rather as theirs than as those of their religion. He walked round the pile of stones three times from left to right repeating his "Om Mani," &c., then stood before it with his head hung down and his long queue streaming behind, and concluded by a votive offering of three pine-cones. When done, he looked round at me, nodded, smirked, elevated the angles of his little turned-up eyes, and seemed to think we were safe from all perils in the valleys yet to be explored.

In the gorge of the Rungeet the heat was intolerable, though the thermometer did not rise above 95°. The mountains leave but a narrow gorge between them, here and there bordered by a belt of strong soil, supporting a towering crop of long cane-like grasses and tall trees. The troubled river, about eighty yards across, rages along over a gravelly bed. Crossing the Rungmo, where it falls into the Rungeet, we came upon a group of natives drinking fermented Murwa liquor under a rock; I had a good deal of difficulty in getting my people past, and more in inducing one of the topers to take the place of a Ghorka (Nepalese) of our party who was ill with fever. Soon afterwards, at a most wild and beautiful spot, I saw, for the first time, one of the most characteristic of Himalayan objects of art, *a cane bridge*. All the spurs, round the bases of which the river flowed, were steep and

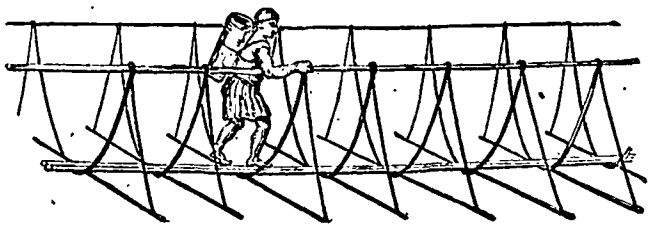
rocky, their flanks clothed with the richest tropical forest, their crests tipped with pines. On the river's edge, the Banana, *Pandanus*, and *Bauhinia*, were frequent, and Figs prevailed. One of the latter (of an exceedingly beautiful species) projected over the



PINES (PINUS LONGIFOLIA), RUNGEET VALLEY.

stream, growing out of a mass of rock, its roots interlaced and grasping at every available support, while its branches, loaded with deep glossy foliage, hung over the water. This tree formed one pier for the canes; that on the opposite bank was constructed of strong piles, propped with large stones, and between them swung

the bridge,[1] about eighty yards long, ever rocking over the torrent (forty feet below). The lightness and extreme simplicity of its structure were very remarkable. Two parallel canes, on the same horizontal plane, were stretched across the stream; from them others hung in loops, and along the loops were laid one or two bamboo stems for flooring; cross pieces below this flooring, hung from the two upper canes, which they thus served to keep apart. The traveller grasps one of the canes in either hand, and walks along the loose bamboos laid on the swinging loops; the motion is great, and the rattling of the loose dry bamboos is neither a musical sound nor one calculated to inspire confidence; the whole structure seeming as if about to break down. With shoes it is not easy to walk; and even with bare feet it is often difficult, there being frequently but one bamboo, which, if the fastening is loose, tilts up, leaving the pedestrian suspended over the torrent by the slender canes. When properly and strongly made, with good fastenings, and a floor of bamboos laid *transversely*, these



bridges are easy to cross. The canes are procured from a species of *Calamus;* they are as thick as the finger, and twenty or thirty yards long, knotted together, and the other pieces are fastened to them by strips of the same plant. A Lepcha, carrying one hundred and forty pounds on his back, crosses without hesitation, slowly but steadily, and with perfect confidence.

A deep broad pool below the bridge was made available for a ferry: the boat was a triangular raft of bamboo stems, with a stage on the top, and it was secured on the opposite side of the stream, having a cane reaching across to that on which we were. A stout Lepcha leapt into the boiling flood and boldly swam across, holding on by the cane, without which he would have been carried away. He unfastened the raft, and we drew it over by the cane, and, seated on the stage up to our knees in water, we were pulled across, the raft bobbing up and down over the rippling stream.

[1] A sketch of one of these bridges will be found later.

We were beyond British ground, on the opposite bank, where any one guiding Europeans is threatened with punishment: we had expected a guide to follow us, but his non-appearance caused us to delay for some hours; four roads, or rather forest paths, meeting here, all of which were difficult to find. After a while, part of a marriage-procession came up, headed by the bride-groom, a handsome young Lepcha, leading a cow for the marriage feast; and after talking to him a little, he volunteered to show us the path. On the flats by the stream grew the Sago palm (*Cycas pectinata*), with a stem ten feet high, and a beautiful crown of foliage: the contrast between this and the Scotch-looking pine (both growing with oaks and palms) was curious. Much of the forest had been burnt, and we traversed large blackened patches, where the heat was intense, and increased by the burning trunks of prostrate trees, which smoulder for months, and leave a heap of white ashes. The larger timber being hollow in the centre, a current of air is produced, which causes the interior to burn rapidly, till the sides fall in, and all is consumed. I was often startled, when walking in the forest, by the hot blast proceeding from such, which I had approached without a suspicion of their being other than cold dead trunks.

Leaving the forest, the path led along the river bank, and over the great masses of rock which strewed its course. The beautiful India-rubber fig was common, as was *Bassia butyracea*, the "Yel Pote" of the Lepchas, from the seeds of which they express a concrete oil, which is received and hardens in bamboo vessels. On the forest-skirts, *Hoya*, parasitical *Orchideæ*, and ferns, abounded; the Chaulmoogra, whose fruit is used to intoxicate fish, was very common; as was an immense mulberry tree, that yields a milky juice and produces a long green sweet fruit. Large fish, chiefly Cyprinoid, were abundant in the beautifully clear water of the river. But by far the most striking feature consisted in the amazing quantity of superb butterflies, large tropical swallow-tails, black, with scarlet or yellow eyes on their wings. They were seen everywhere, sailing majestically through the still hot air, or fluttering from one scorching rock to another, and especially loving to settle on the damp sand of the river-edge; where they sat by thousands, with erect wings, balancing themselves with a rocking motion, as their heavy sails inclined them to one side or the other, resembling a crowded fleet of yachts on a calm day. Such an entomological display cannot be surpassed. *Cincindelæ* were very numerous and incredibly active, as were *Grylli*; and the great *Cicadeæ* were everywhere lighting on the

ground, when they uttered a short sharp creaking sound, and anon disappeared as if by magic. Beautiful whip-snakes were gleaming in the sun: they hold on by a few coils of the tail round a twig, the greater part of the body stretched out horizontally, occasionally retracting, and darting with unerring aim at some insect. The narrowness of the gorge, and the excessive steepness of the bounding hills, prevented any view, except of the opposite mountain face, which was one dense forest, in which the wild Banana was conspicuous.

Towards evening we arrived at another cane bridge, still more dilapidated than the former, but similar in structure. For a few hundred yards before reaching it we lost the path, and followed the precipitous face of slate-rocks overhanging the stream, which dashed with great violence below. Though we could not walk comfortably, even with our shoes off, the Lepchas, bearing their enormous loads, proceeded with perfect indifference.

Anxious to avoid sleeping at the bottom of the valley, we crawled, very much fatigued, through burnt dry forest, up a very sharp ridge, so narrow that the tent sate astride on it, the ropes being fastened to the tops of small trees on either slope. The ground swarmed with black ants, which got into our tea, sugar, &c., while it was so covered with charcoal that we were soon begrimed. Our Lepchas preferred remaining on the river-bank, whence they had to bring up water to us in great bamboo "chungis," as they are called. The great dryness of this face is owing to its southern exposure: the opposite mountains, equally high and steep, being clothed in a rich green forest.

At nine the next morning, the temperature was 78°, but a fine cool easterly wind blew. Descending to the bed of the river, the temperature was 84°. The difference in humidity of the two stations (with about 300 feet difference in height) was more remarkable; at the upper, the wet bulb thermometer was 67½°, and consequently the saturation point, 0·713; at the lower, the wet bulb was 68°, and saturation, 0·599. The temperature of the river was, at all hours of the preceding day, and this morning, 67½°.[1]

Our course down the river was by so rugged a path, that, giddy

[1] At this hour, the probable temperature at Darjeeling (6,000 feet above this) would be 56°, with a temperature of wet bulb 55°, and the atmosphere loaded with vapour. At Calcutta, again, the temperature was at the observatory 91·3°, wet bulb, 81·8°, and saturation=0.737. The dryness of the air, in the damper-looking and luxuriant river-bed, was owing to the heated rocks of its channel; while the humidity of the atmosphere over the drier-looking hill where we encamped, was due to the moisture of the wind then blowing.

and footsore with leaping from rock to rock, we at last attempted the jungle, but it proved utterly impervious. On turning a bend of the stream, the mountains of Bhotan suddenly presented themselves, with the Teesta flowing at their base; and we emerged at the angle formed by the junction of the Rungeet, which we had followed from the west, of the Teesta coming from the north, and of their united streams flowing south.

We were not long before enjoying the water, when I was surprised to find that of the Teesta singularly cold; its temperature being 7° below that of the Rungeet.[1] At the salient angle (a rocky peninsula) of their junction, we could almost place one foot in the cold stream and the other in the warmer. There is a no less marked difference in the colour of the two rivers; the Teesta being sea-green and muddy, the Great Rungeet dark green and very clear; and the waters, like those of the Arve and Rhone at Geneva, preserve their colours for some hundred yards; the line separating the two being most distinctly drawn. The Teesta, or main stream, is much the broadest (about 80 or 100 yards wide at this season), the most rapid and deep. The rocks which skirt its bank were covered with a silt or mud deposit, which I nowhere observed along the Great Rungeet, and which, as well as its colour and coldness, was owing to the vast number of then melting glaciers drained by this river. The Rungeet, on the other hand, though it rises amongst the glaciers of Kinchinjunga and its sister peaks, is chiefly supplied by the rainfall of the outer ranges of Sinchul and Singalelah, and hence its waters are clear, except during the height of the rains.

From this place we returned to Darjeeling, arriving on the afternoon of the following day.

The most interesting trip to be made from Darjeeling, is that to the summit of Tonglo, a mountain on the Singalelah range, 10,079 feet high, due west of the station, and twelve miles in a straight line, but fully thirty by the path.[2]

Leaving the station by a native path, the latter plunges at once into a forest, and descends very rapidly, occasionally emerging on cleared spurs, where are fine crops of various millets, with much

[1] This is, no doubt, due partly to the Teesta flowing south, and thus having less of the sun, and partly to its draining snowy mountains throughout a much longer portion of its course. The temperature of the one was 67½°, and that of the other 60½°.

[2] A full account of the botanical features noticed on this excursion (which I made in May, 1848, with Mr. Barnes) has appeared in the "London Journal of Botany," and the "Horticultural Society's Journal," and I shall, therefore, recapitulate its leading incidents only.

maize and rice. Of the latter grain as many as eight or ten varieties are cultivated, but seldom irrigated, which, owing to the dampness of the climate, is not necessary: the produce is often eighty-fold, but the grain is large, coarse, reddish, and rather gelatinous when boiled. After burning the timber, the top soil is very fertile for several seasons, abounding in humus, below which is a stratum of stiff clay, often of great thickness, produced by the disintegration of the rocks;[1] the clay makes excellent bricks, and often contains nearly 30 per cent. of alumina.

At about 4,000 feet the great bamboo ("Pao" Lepcha) abounds; it flowers every year, which is not the case with all others of this genus, most of which flower profusely over large tracts of country, once in a great many years, and then die away; their place being supplied by seedlings, which grow with immense rapidity. This well-known fact is not due, as some suppose, to the life of the species being of such a duration, but to favourable circumstances in the season. The Pao attains a height of 40 to 60 feet, and the culms average in thickness the human thigh; it is used for large water-vessels, and its leaves form admirable thatch, in universal use for European houses at Darjeeling. Besides this, the Lepchas are acquainted with nearly a dozen kinds of bamboo; these occur at various elevations below 12,000 feet, forming, even in the pine-woods, and above their zone, in the skirts of the *Rhododendron* scrub, a small and sometimes almost impervious jungle. In an enconomical point of view they may be classed as those which split readily, and those which do not. The young shoots of several are eaten, and the seeds of one are made into a fermented drink, and into bread in times of scarcity; but it would take many pages to describe the numerous purposes to which the various species are put.

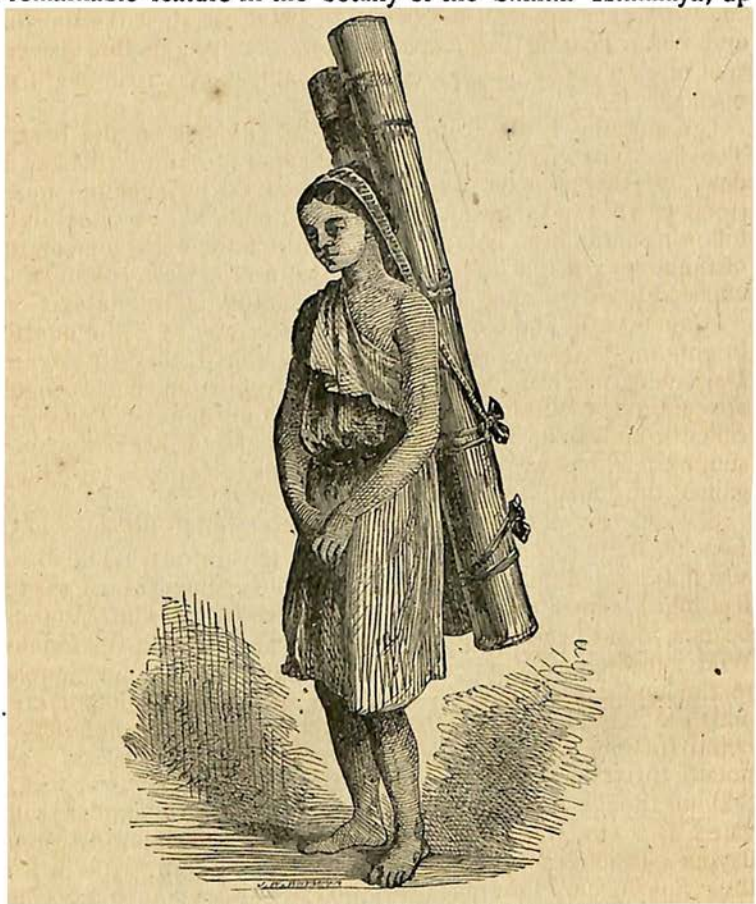
Gordonia is their most common tree (*G. Wallichii*), much prized for ploughshares and other purposes requiring a hard wood: it is the "Sing-brang-kun" of the Lepchas, and ascends to 4,000 feet. Oaks at this elevation occur as solitary trees, of species different from those of Darjeeling. There are three or four with a cup-shaped involucre, and three with spinous involucres enclosing an eatable sweet nut; these latter generally grow on a dry clayey soil.

Some low steep spurs were well cultivated, though the angle of the field was upwards of 25°; the crops, chiefly maize, were just sprouting. This plant is occasionally hermaphrodite in Sikkim, the flowers forming a large drooping panicle and ripening small

[1] An analysis of the soil will be found in the Appendix.

grains; it is, however, a rare occurrence, and the specimens are highly valued by the people.

The general prevalence of figs,[1] and their allies, the nettles,[2] is a remarkable feature in the botany of the Sikkim Himalaya, up



LEPCHA WATER-CARRIER WITH A BAMBOO CHUNGI.

to nearly 10,000 feet. Of the former there were here five species,

[1] One species of this very tropical genus ascends almost to 9,000 feet on the outer ranges of Sikkim.

[2] Of two of these cloth is made, and of a third, cordage. The tops of two are eaten, as are several species of *Procris*. The "Poa" belongs to this order, yielding that kind of grass cloth fibre now abundantly imported into England from the Malay Islands, and used extensively for shirting.

some bearing eatable and very palatable fruit of enormous size, others with the fruit small and borne on prostrate, leafless branches, which spring from the root and creep along the ground.

A troublesome, dipterous insect (the "Peepsa," a species of *Siamulium*) swarms on the banks of the streams; it is very small and black, floating like a speck before the eye; its bite leaves a spot of extravasated blood under the cuticle, very irritating if not opened.

Crossing the Little Rungeet river, we camped on the base of Tonglo. The night was calm and clear, with faint cirrus but no dew. A thermometer sunk two feet in rich vegetable mould stood at 78° two hours after it was lowered, and the same on the following morning. This probably indicates the mean temperature of the month at that spot, where, however, the dark colour of the exposed loose soil must raise the temperature considerably.

May 20th.—The temperature at sunrise was 67°; the morning bright, and clear overhead, but the mountains looked threatening. Darjeeling, perched on a ridge 5,000 feet above us, had a singular appearance. We ascended the Simonbong spur of Tonglo, so called from a small village and Lama temple of that name on its summit; where we arrived at noon, and passing some chaits[1] gained the Lama's residence.

Two species of bamboo, the "Payong" and "Praong" of the Lepchas, here replace the Pao of the lower regions. The former was flowering abundantly, the whole of the culms (which were 20 feet high) being a diffuse panicle of inflorescence. The "Praong" bears a round head of flowers at the ends of the leafy branches. Wild strawberry, violet, geranium, &c., announced our approach to the temperate zone. Around the temple were potato crops and peach-trees, rice, millet, yam, brinjal (egg-apple), fennel, hemp (for smoking its narcotic leaves), and cummin, &c. The potato thrives extremely well as a summer crop, at 7,000 feet, in Sikkim, though I think the root (from the Darjeeling stock) cultivated as a winter crop in the plains, is superior both in size and flavour. Peaches never ripen in this part of Sikkim, apparently from the want of sun; the tree grows well at from 3,000 to 7,000 feet elevation, and flowers abundantly; the fruit making the nearest approach to maturity (according to the elevation) from July to

[1] The chait of Sikkim, borrowed from Tibet, is a square pedestal surmounted with a hemisphere, the convex end downwards, and on it is placed a cone, with a crescent on the top. These are erected as tombs to Lamas and as monuments to illustrious persons, and are venerated accordingly, the people always passing them from left to right, often repeating the invocation, "Om Mani Padmi om."

October. At Darjeeling it follows the English seasons, flowering in March and fruiting in September, when the scarce reddened and still hard fruit falls from the tree. In the plains of India, both this and the plum ripen in May, but the fruits are very acid.

It is curious that throughout this temperate region there is hardly an eatable fruit except the native walnut, and some brambles, of which the "yellow" and "ground raspberry" are the best, some insipid figs, and a very austere crab-apple. The European apple will scarcely ripen,[1] and the pear not at all. Currants and gooseberries show no disposition to thrive, and strawberries are the only fruits that ripen at all, which they do in the greatest abundance. Vines, figs, pomegranates, plums, apricots, &c., will not succeed even as trees. European vegetables again grow, and thrive remarkably well throughout the summer of Darjeeling, and the produce is very fair, sweet and good, but inferior in flavour to the English.

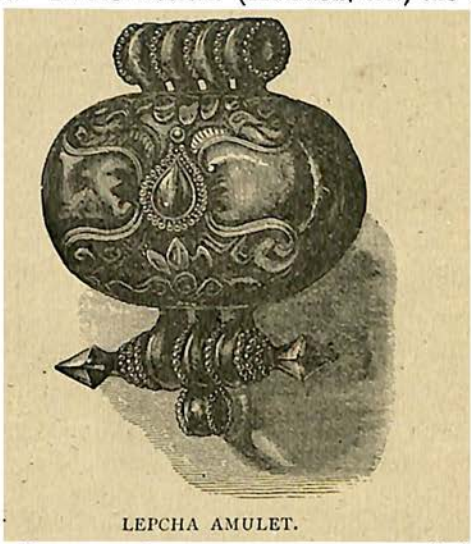
Of tropical fruits cultivated below 4,000 feet; oranges and indifferent bananas alone are frequent, with lemons of various kinds. The season for these is, however, very short; though that of the plantain might with care be prolonged; oranges abound in winter, and are excellent, but neither so large nor free of white pulp as those of the Khasia hills, the West Indies, or the west coast of Africa. Mangos are brought from the plains, for though wild in Sikkim, the cultivated kinds do not thrive; I have seen the pine-apple plant, but I never met with good fruit on it.

A singular and almost total absence of the light, and of the direct rays of the sun in the ripening season, is the cause of this dearth of fruit. Both the farmer and orchard gardener in England know full well the value of a bright sky as well as of a warm autumnal atmosphere. Without this corn does not ripen, and fruit-trees are blighted. The winter of the plains of India being more analogous in its distribution of moisture and heat to a European summer, such fruits as the peach, vine, and even plum, fig, strawberry, &c., may be brought to bear well in March, April, and May, if they are only carefully tended through the previous hot and damp season, which is, in respect to the functions of flowering and fruiting, their winter.

Hence it appears that, though some English fruits will turn the winter solstice of Bengal (November to May) into summer, and

[1] This fruit and several others ripen at Katmandoo, in Nepal (alt. 4,000 feet), which place enjoys more sunshine than Sikkim. I have, however, received very different accounts of the produce, which, on the whole, appears to be inferior.

then flower and fruit, neither these nor others will thrive in the summer of 7,000 feet on the Sikkim Himalaya (though its temperature so nearly approaches that of England), on account of its rain and fogs. Further, they are often exposed to a winter's cold equal to the average of that of London, the snow lying for a week on the ground, and the thermometer descending to 25°. It is true that in no case is the extreme of cold so great here as in England, but it is sufficient to check vegetation, and to prevent fruit-trees from flowering till they are fruiting in the plains. There is in this respect a great difference between the climate of the central and eastern and western Himalaya, at equal elevations. In the western (Kumaon, &c.) the winters are



LEPCHA AMULET.

colder than in Sikkim—the summers warmer and less humid. The rainy season is shorter, and the sun shines so much more frequently between the heavy showers, that the apple and other fruits are brought to a much better state. It is true that the rain-gauge may show as great a fall there, but this is no measure of the humidity of the atmosphere, and still less so of the amount of the sun's direct light and heat intercepted by aqueous vapour, for it takes no account of the quantity of moisture suspended in the air, nor of the depositions from fogs, which are far more fatal to the perfecting of fruits than the heaviest brief showers.

The Indian climate, which is marked by one season of excessive humidity and the other of excessive drought, can never be

favourable to the production either of good European or tropical fruits. Hence there is not one of the latter peculiar to the country, and perhaps but one which arrives at full perfection; namely, the mango. The plantains, oranges, and pine-apples are less abundant, of inferior kinds, and remain a shorter season in perfection than they do in South America, the West Indies, or Western Africa.

CHAPTER VII.

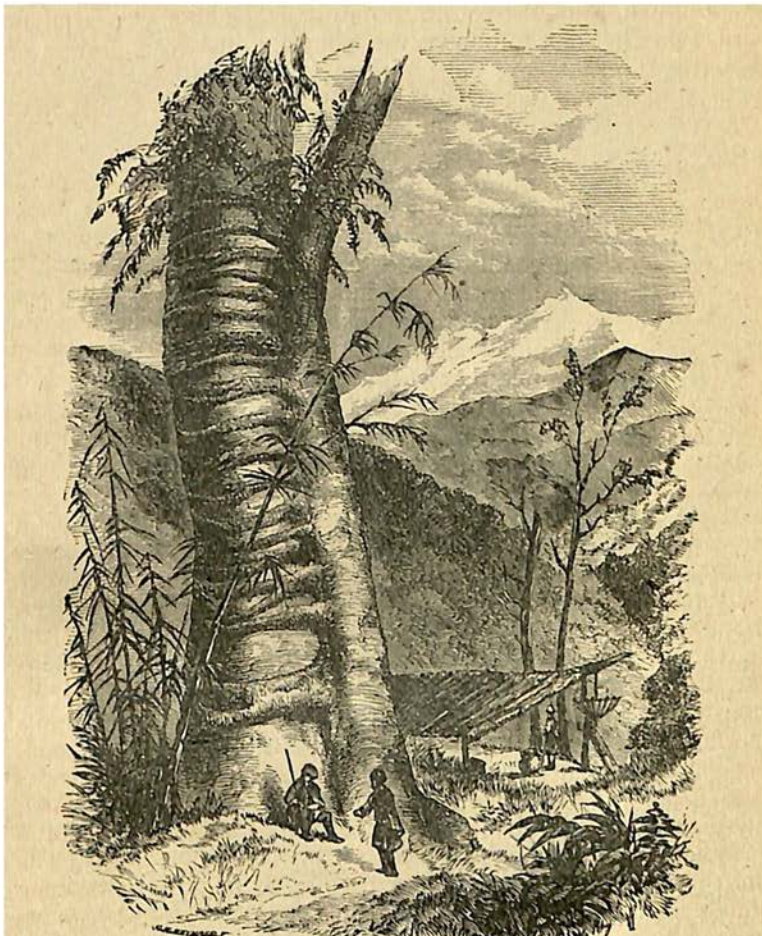
Continue. the ascent of Tonglo—Trees—Lepcha construction of hut—Simisbo — Climbing-trees — Frogs—Magnolias, &c.— Ticks— Leeches—Cattle, murrain amongst—Summit of Tonglo—Rhododendrons—Skimmia—Yew—Rose—Aconite—Bikh poison—English genera of plants—Ascent of tropical orders—Comparison with south temperate zone—Heavy rain—Temperature, &c.—Descent—Simonbong temple—Furniture therein—Praying-cylinder—Thigh-bone trumpet—Morning orisons—Present of Murwa beer, &c.

CONTINUING the ascent of Tonglo, we left cultivation and the poor groves of peaches at 4,000 to 5,000 feet (and this on the eastern exposure, which is by far the sunniest), the average height which agriculture reaches in Sikkim.

Above Simonbong, the path up Tonglo is little frequented: it is one of the many routes between Nepal and Sikkim, which cross the Singalelah spur of Kinchinjunga at various elevations between 7,000 and 15,000 feet. As usual, the track runs along ridges, wherever these are to be found, very steep, and narrow at the top, through deep humid forests of oaks and Mangolias, many laurels, both *Tetranthera* and *Cinnamomum*, one species of the latter ascending to 8,500 feet, and one of *Tetranthera* to 9,000. Chesnut and walnut here appeared, with some leguminous trees, which however did not ascend to 6,000 feet. Scarlet flowers of *Vaccinium serpens*, an epiphytical species, were strewed about, and the great blossoms of *Rhododendron Dalhousiæ* and of a Magnolia (*Talauma Hodgsoni*) lay together on the ground. The latter forms a large tree, with very dense foliage, and deep shining green leaves, a foot to eighteen inches long. Most of its flowers drop unexpanded from the tree, and diffuse a very aromatic smell; they are nearly as large as the fist, the outer petals purple, the inner pure white.

Heavy rain came on at 3 P.M., obliging us to take insufficient shelter under the trees, and finally to seek the nearest camping-ground. For this purpose we ascended to a spring, Simsibong, at

an elevation of 6,000 feet. The narrowness of the ridge prevented our pitching the tent, small as it was; but the Lepchas rapidly constructed a house, and thatched it with bamboo and the broad leaves of the wild plantain. A table was then raised



CLASPING ROOTS OF WIGHTIA.

in the middle, of four posts and as many cross pieces of wood, lashed with strips of bamboo. Across these, pieces of bamboo were laid, ingeniously flattened by selecting cylinders, crimping

them all round, and then slitting each down one side, so that it opens into a flat slab. Similar but lower and longer erections, one on each side the table, formed bed or chair; and in one hour, half a dozen men, with only long knives and active hands, had provided us with a tolerably water-tight furnished house. A thick flooring of bamboo leaves kept the feet dry, and a screen of that and other foliage all round rendered the habitation tolerably warm.

At this elevation we found great scandent trees twisting around the trunks of others, and strangling them: the latter gradually decay, leaving the sheath of climbers as one of the most remarkable vegetable phenomena of these mountains. These climbers belong to several orders, and may be roughly classified in two groups.—(1) Those whose stems merely twine, and by constricting certain parts of their support, induce death.—(2) Those which form a network round the trunk, by the coalescence of their lateral branches and aerial roots, &c.: these wholly envelop and often conceal the tree they enclose, whose branches appear rising far above those of its destroyer. To the first of these groups belong many natural orders, of which the most prominent are—*Leguminosæ*, ivies, hydrangea, vines, *Pothos*, &c. The inosculating ones are almost all figs and *Wightia:* the latter is the most remarkable, and I add a cut of its grasping roots, sketched at our encampment.

Except for the occasional hooting of an owl, the night was profoundly still during several hours after dark—the cicadas at this season not ascending so high on the mountain. A dense mist shrouded everything, and the rain pattered on the leaves of our hut. At midnight a tree-frog ("Simook," Lepcha) broke the silence with his curious metallic clack, and others quickly joined the chorus, keeping up their strange music till morning. Like many Batrachians, this has a voice singularly unlike that of any other organised creature. The cries of beasts, birds, and insects are all explicable to our senses, and we can recognise most of them as belonging to such or such an order of animal; but the voices of many frogs are like nothing else, and allied species utter totally dissimilar noises. In some, as this, the sound is like the concussion of metals; in others, of the vibration of wires or cords; anything but the natural effects of lungs, larynx and muscles.[1]

May 21.—Early this morning we proceeded upwards, our pros-

[1] A very common Tasmanian species utters a sound that appears to ring in an underground vaulted chamber, beneath the feet.

pect more gloomy than ever. The path, which still lay up steep ridges, was very slippery owing to the rain upon the clayey soil, and was only passable from the hold afforded by interlacing roots of trees. At 8,000 feet, some enormous detached masses of micaceous gneiss rose abruptly from the ridge; they were covered with mosses and ferns, and from their summit a good view of the surrounding vegetation is obtained. The mass of the forest is formed of:—(1) Three species of oak, of which *Q. annulata?* with immense lamellated acorns, and leaves sixteen inches long, is the tallest and the most abundant.—(2) Chesnut.—(3) *Laurineæ* of several species, all beautiful forest-trees, straight-boled, and umbrageous above.—(4) Magnolias.[1]—(5) Arborescent rhododendrons, which commence here with the *R. arboreum*. At 8,000 and 9,000 feet, a considerable change is found in the vegetation; the gigantic purple *Magnolia Campbellii* replacing the white; chesnut disappears, and several laurels: other kinds of maple are seen, with *Rhododendron argenteum*, and *Stauntonia*, a handsome climber, which has beautiful pendent clusters of lilac blossoms.

At 9,000 feet we arrived on a long flat covered with lofty trees, chiefly purple magnolias, with a few oaks, great *Pyri* and two rhododendrons, thirty to forty feet high (*R. barbatum*, and *R. aboreum*, var. *roseum*): *Skimmia* and *Symplocos* were the common shrubs. A beautiful orchid with purple flowers (*Cœlogyne Wallichii*) grew on the trunks of all the great trees, attaining a a higher elevation than most other epiphytical species, for I have seen it at 10,000 feet.

A large tick infests the small bamboo, and a more hateful insect I never encountered. The traveller cannot avoid these insects coming on his person (sometimes in great numbers) as he brushes through the forest; they get inside his dress, and insert the proboscis deeply without pain. Buried head and shoulders, and retained by a barbed lancet, the tick is only to be extracted by force, which is very painful. I have devised many tortures, mechanical and chemical, to induce these disgusting intruders to withdraw the proboscis, but in vain. Leeches,[2] also

[1] Other trees were *Pyrus*, *Saurauja* (both an erect and climbing species), *Olea*, cherry, birch, alder, several maples, *Hydrangea*, one species of fig, holly, and several *Araliaceous* trees. Many species of *Magnoliaceæ* (including the genera *Magnolia*, *Michelia*, and *Talauma*) are found in Sikkim: *Magnolia Campbellii*, of 10,000 feet, is the most superb species known. In books on botanical geography, the magnolias are considered as most abounding in North America, east of the Rocky Mountains; but this is a great mistake, the Indian mountains and islands being the centre of this natural order.

[2] I cannot but think that the extraordinary abundance of these *Anelides* in

below 7,000 feet; a small black species above 3,000 feet, and a large yellow-brown solitary one below that elevation.

Our ascent to the summit was by the bed of a watercourse, now a roaring torrent, from the heavy and incessant rain. A small *Anagallis* (like *tenella*), and a beautiful purple primrose, grew by its bank. The top of the mountain is another flat ridge, with depressions and broad pools. The number of additional species of plants found here was great, and all betokened a rapid approach to the alpine region of the Himalaya. In order of prevalence the trees were,—the scarlet *Rhododendron arboreum* and *barbatum*, as large bushy trees, both loaded with beautiful flowers and luxuriant foliage; *R. Falconeri*, in point of foliage the most superb of all the Himalayan species, with trunks thirty feet high, and branches bearing at their ends only leaves eighteen inches long: these are deep green above, and covered beneath with a rich brown down. Next in abundance to these were shrubs of *Skimmia Laureola*,[1] *Symplocos*, and Hydrangea; and there were still a few purple magnolias, very large *Pyri*, like mountain ash, and the common English yew, eighteen feet in circumference, the red bark of which is used as a dye, and for staining the foreheads of Brahmins in Nepal. An erect white-flowered rose (*R. sericea*, the only species occurring in Southern Sikkim) was very abundant: its numerous inodorous flowers are pendent, apparent as a protection from the rain; and it is remarkable as being the only species having four petals instead of five.

A currant was common, always growing epiphytically on the trunks of large trees. Two or three species of Berberry, a cherry, Andromeda, *Daphne*, and maple, nearly complete, I think, the list of woody plants. Amongst the herbs were many of great interest, as a rhubarb, and *Aconitum palmatum*, which yields one

Sikkim may cause the death of many animals. Some marked murrains have followed very wet seasons, when the leeches appear in incredible numbers; and the disease in the cattle, described to me by the Lepchas as in the stomach, in no way differs from what leeches would produce. It is a well-known fact, that these creatures have lived for days in the fauces, nares, and stomachs of the human subject, causing dreadful sufferings, and death. I have seen the cattle feeding in places where leeches so abounded, that fifty or sixty were frequently together on my ankles; and ponies are almost maddened by their biting the fetlocks.

[1] This plant has lately been introduced into English gardens, from the north-west Himalaya, and is greatly admired for its aromatic, evergreen foliage, and clusters of scarlet berries. It is a curious fact, that this plant never bears scarlet berries in Sikkim, apparently owing to the want of sun; the fruit ripens, but is of a greenish-red or purplish colour.

of the celebrated "Bikh" poisons.[1] Of European genera I found *Thalictrum*, *Anemone*, *Fumaria*, violets, *Stellaria*, *Hypericum*, two geraniums, balsams, *Epilobium*, *Potentilla*, *Paris* and *Convallariæ*, one of the latter has verticillate leaves, and its root, also called "bikh," is considered a very virulent poison.

Still, the absence or rarity at this elevation of several very large natural families,[2] which have numerous representatives at and much below the same level in the inner ranges, and on the outer of the Western Himalaya, indicate a certain peculiarity in Sikkim. On the other hand, certain tropical genera are more abundant in the temperate zone of the Sikkim mountains, and ascend much higher there than in the Western Himalaya: of this fact I have cited conspicuous examples in the palms, plantains, and tree-ferns. This ascent and prevalence of tropical species is due to the humidity and equability of the climate in this temperate zone, and is, perhaps, the direct consequence of these conditions. An application of the same laws accounts for the extension of similar features far beyond the tropical limit in the Southern Ocean, where various natural orders, which do not cross the 30th and 40th parallels of N. latitude, are extended to the 55th of S. latitude, and found in Tasmania, New Zealand, the so-called Antarctic Islands south of that group, and at Cape Horn itself.

The rarity of Pines is perhaps the most curious feature in the botany of Tonglo, and on the outer ranges of Sikkim; for, between the level of 2,500 feet (the upper limit of *P. longifolia*) and 10,000 feet (that of the *Taxus*), there is no coniferous tree whatever in Southern Sikkim.

We encamped amongst Rhododendrons, on a spongy soil of black vegetable matter, so oozy that it was difficult to keep the feet dry. The rain poured in torrents all the evening, and with the calm, and the wetness of the wood, prevented our enjoying a fire. Except a transient view into Nepal, a few miles west of us, nothing was to be seen, the whole mountain being wrapped in dense masses of vapour. Gusts of wind, not felt in the forest, whistled through the gnarled and naked tree-tops; and though the temperature was 50°, this wind produced cold to the feelings.

[1] "Bikh" is yielded by various *Aconita*. All the Sikkim kinds are called "gniong" by Lepchas and Bhoteeas, who do not distinguish them. The *A. Napellus* is abundant in the north-west Himalaya, aud is perhaps as virulent a Bikh as any species.

[2] *Ranunculaceæ*, *Fumariæ*, *Cruciferæ*, *Alsineæ*, *Geranieæ*, *Leguminosæ*, *Potentilla*, *Epilobium*, *Crassulaceæ*, *Saxifrageæ*, *Umbelliferæ*, *Loniceræ*, *Valerianeæ*, *Dipsaceæ*, various genera of *Compositæ*, *Campanulaceæ*, *Lobeliaceæ*, *Gentianeæ*, *Borragineæ*, *Scrophularineæ*, *Primulaceæ*, *Gramineæ*.

Our poor Lepchas were miserably off, but always happy: under four posts and a bamboo-leaf thatch, with no covering but a single thin cotton garment, they crouched on the sodden turf, joking with the Hindoos of our party, who, though supplied with good clothing and shelter, were doleful companions.

I made a shed for my instruments under a tree; Mr. Barnes, ever active and ready, floored the tent with logs of wood, and I laid a "corduroy road" of the same to my little observatory.

During the night the rain did not abate; and the tent-roof leaked in such torrents, that we had to throw pieces of wax-cloth over our shoulders as we lay in bed. There was no improvement whatever in the weather on the following morning. Two of the Hindoos had crawled into the tent during the night, attacked with fever and ague.[1] The tent being too sodden to be carried, we had to remain where we were, and with abundance of novelty in the botany around, I found no difficulty in getting through the day. Observing the track of sheep, we sent two Lepchas to follow them, who returned at night from some miles west in Nepal, bringing two. The shepherds were Geroongs of Nepal, who were grazing their flocks on a grassy mountain top, from which the woods had been cleared, probably by fire. The mutton was a great boon to the Lepchas, but the Hindoos would not touch it, and several more sickening during the day, we had the tent most uncomfortably full.

During the whole of the 22nd, from 7 A.M. to 11 P.M., the thermometer never varied 6½ degrees, ranging from 47½ in the morning to 54°, its maximum, at 1 P.M., and 50¾ at night. At seven the following morning it was the same. One, sunk two feet six inches in mould and clay, stood constantly at 50¾. The dew-point was always below the temperature, at which I was surprised, for more drenching weather could not well be. The mean dew-point was 50½, and consequent humidity, 0·973.

These observations, and those of the barometer, were taken 60 feet below the summit, to which I moved the instruments on the morning of the 23rd. At a much more exposed spot the results would no doubt have been different, for a thermometer, there sunk to the same depth as that below, stood at 49¾ (or one degree colder than 60 feet lower down). My barometrical observations,

[1] It is a remarkable fact, that both the natives of the plains, under many circumstances, and the Lepchas when suffering from protracted cold and wet, take fever and ague in sharp attacks. The disease is wholly unknown amongst Europeans residing above 4,000 feet, similar exposure in whom brings on rheumatism and cold.

taken simultaneously with those of Calcutta, give the height of Tonglo, 10,078·3 feet : Colonel Waugh's, by trigonometry, 10,079·4 feet—a remarkable and unusual coincidence.

May 23.—We spent a few hours of alternate fog and sunshine on the top of the mountain, vainly hoping for the most modest view; our inability to obtain it was extremely disappointing, for the mountain commands a superb prospect, which I enjoyed fully in the following November, from a spot a few miles further west. The air, which was always foggy, was alternately cooled and heated, as it blew over the trees, or the open space we occupied; sometimes varying 5° and 6° in a quarter of an hour.

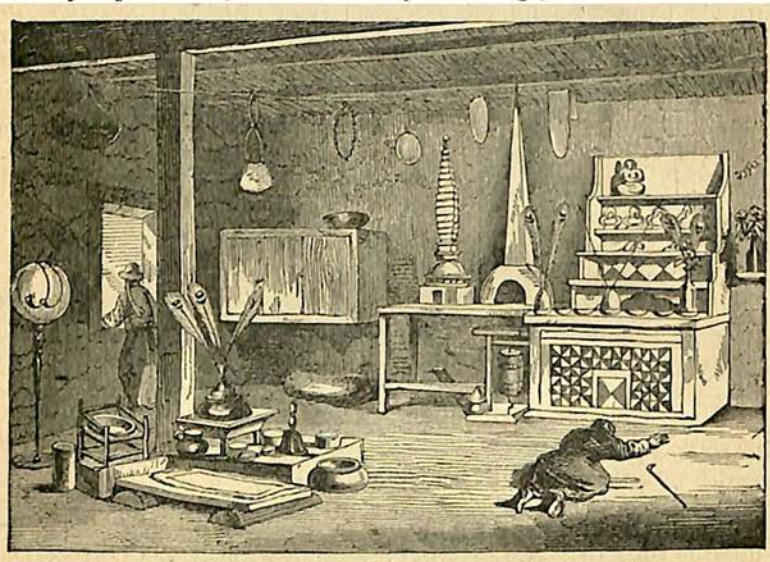
Having partially dried the tent in the wind, we commenced the descent, which, owing to the late torrents of rain, was most fatiguing and slippery; it again commenced to drizzle at noon, nor was it till we had descended to 6,000 feet that we emerged from the region of clouds. By dark we arrived at Simonbong, having descended 5,000 feet, at the rate of 1,000 feet an hour; and were kindly received by the Lama, who gave us his temple for the accommodation of the whole party. We were surprised at this, both because the Sikkim authorities had represented the Lamas as very averse to Europeans, and because he might well have hesitated before admitting a promiscuous horde of thirty people into a sacred building, where the little valuables on the altar, &c., were quite at our disposal. A better tribute could not well have been paid to the honesty of my Lepcha followers. Our host only begged us not to disturb his people, nor to allow the Hindoos of our party to smoke inside.

Simonbong is one of the smallest and poorest Gumpas, or temples, in Sikkim: unlike the better class, it is built of wood only. It consisted of one large room, with small sliding shutter windows, raised on a stone foundation, and roofed with shingles of wood; opposite the door a wooden altar was placed, rudely chequered with black, white, and red; to the right and left were shelves, with a few Tibetan books, wrapped in silk; a model of Symbonath temple in Nepal, a praying-cylinder,[1] and some implements for common purposes, bags of juniper, English wine-bottles and glasses, with tufts of *Abies Webbiana*, rhododendron

[1] It consisted of a leathern cylinder placed upright in a frame; a projecting piece of iron strikes a little bell at each revolution, the revolution being caused by an elbowed axle and string. Within the cylinder are deposited written prayers, and whoever pulls the string properly is considered to have repeated his prayers as often as the bell rings. Representations of these implements will be found in other parts of this volume.

flowers, and peacock's feathers, besides various trifles, clay ornaments and offerings, and little Hindoo idols. On the altar were ranged seven little brass cups, full of water; a large conch shell, carved with the sacred lotus; a brass jug from Lhassa, of beautiful design, and a human thigh-bone, hollow, and perforated through both condyles.[1]

Facing the altar was a bench and a chair, and on one side a huge tambourine, with two curved iron drum-sticks. The bench was covered with bells, handsomely carved with idols, and censers with juniper-ashes; and on it lay the *dorge*, or double-headed



SIMONBONG TEMPLE.

thunderbolt, which the Lama holds in his hand during service. Of all these articles, the human thigh-bone is by much the most curious; it is very often that of a Lama, and is valuable in proportion to its length.[2] As, however, the Sikkim Lamas are burned, the relics are generally procured from Tibet, where the

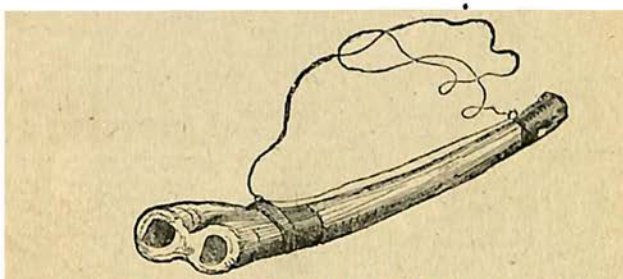
[1] To these are often added a double-headed rattle, or small drum, formed of two crowns of human skulls, cemented back to back; each face is then covered with parchment, and encloses some pebbles. Sometimes this instrument is provided with a handle.

[2] It is reported at Darjeeling, that one of the first Europeans buried at this station, being a tall man, was disinterred by the resurrectionist Bhoteeas for his *trumpet-bones*.

corpses are cut in pieces and thrown to the kites, or into the water.

Two boys usually reside in the temple, and their beds were given up to us, which being only rough planks laid on the floor, proved clean in one sense, but contrasted badly with the springy couch of bamboo the Lepcha makes, which renders carrying a mattress or aught but blankets superfluous.

May 24.—We were awakened at daylight by the discordant orisons of the Lama; these commenced by the boys beating the great tambourine, then blowing the conch-shells, and finally the trumpets and thigh-bone. Shortly the Lama entered, clad in scarlet, shorn and barefooted, wearing a small red silk mitre, a loose gown girt round the middle, and an under-garment of questionable colour, possibly once purple. He walked along, slowly muttering his prayers, to the end of the apartment, whence he took a brass bell and dorge, and, sitting down cross-legged,



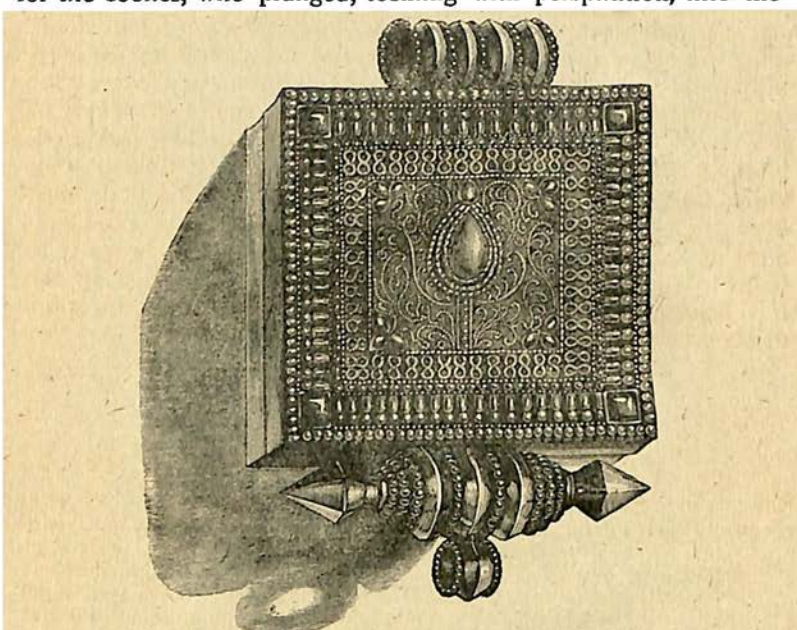
TRUMPET MADE OF A HUMAN THIGH-BONE.

commenced matins, counting his beads, or ringing the bell, and uttering most dismal prayers. After various disposals of the cups, a larger bell was violently rung for some minutes, himself snapping his fingers and uttering most unearthly sounds. Finally, incense was brought, of charcoal with juniper-sprigs; it was swung about, and concluded the morning service, to our great relief, for the noises were quite intolerable. Fervid as the devotions appeared, to judge by their intonation, I fear the Lama felt more curious about us than was proper under the circumstances; and when I tried to sketch him, his excitement knew no bounds; he fairly turned round on the settee, and, continuing his prayers and bell-accompaniment, appeared to be exorcising me, or some spirit within me.

After breakfast the Lama came to visit us, bringing rice, a few vegetables, and a large bamboo-work bowl, thickly varnished with

india-rubber, and waterproof, containing half-fermented millet. This mixture, called *Murwa*, is invariably offered to the traveller, either in the state of fermented grain, or more commonly in a bamboo jug, filled quite up with warm water; when the fluid, sucked through a reed, affords a refreshing drink. He gratefully accepted a few rupees and trifles which we had to spare.

Leaving Simonbong, we descended to the Little Rungeet, where the heat of the valley was very great; 80° at noon, and that of the stream 69°; the latter was an agreeable temperature for the coolies, who plunged, teeming with perspiration, into the



TIBETAN AMULET.

water, catching fish with their hands. We reached Darjeeling late in the evening, again drenched with rain; our people, Hindoo and Lepcha, imprudently remaining for the night in the valley. Owing probably as much to the great exposure they had lately gone through, as to the sudden transition from a mean temperature of 50° in a bracing wind, to a hot close jungly valley at 75°, no less than seven were laid up with fever and ague.

Few excursions can afford a better idea of the general features and rich luxuriance of the Sikkim Himalaya than that to Tonglo.

It is always interesting to roam with an aboriginal, and especially a mountain people, through their thinly inhabited valleys, over their grand mountains, and to dwell alone with them in their gloomy and forbidding forests, and no thinking man can do so without learning much, however slender be the means at his command for communion. A more interesting and attractive companion than the Lepcha I never lived with: cheerful, kind, and patient with a master to whom he is attached; rude but not savage, ignorant and yet intelligent; with a simple resource of a plain knife he makes his house and furnishes yours, with a speed, alacrity, and ingenuity that wile away that well-known long hour when the weary pilgrim frets for his couch. In all my dealings with these people, they proved scrupulously honest. Except for drunkenness and carelessness, I never had to complain of any of the merry troop; some of whom, bareheaded and barelegged, possessing little or nothing save a cotton garment and a long knife, followed me for many months on subsequent occasions, from the scorching plains to the everlasting snows. Ever foremost in the forest or on the bleak mountain, and ever ready to help, to carry, to encamp, collect, or cook, they cheer on the traveller by their unostentatious zeal in his service, and are spurs to his progress.

CHAPTER VIII.

Difficulty in procuring leave to enter Sikkim—Obtain permission to travel in East Nepal—Arrangements—Coolies—Stores—Servants—Personal equipment—Mode of travelling—Leave Darjeeling—Goong ridge—Behaviour of Bhotan coolies—Nepal frontier—Myong valley—Ilan—Sikkim massacre—Cultivation—Nettles—Camp at Nanki on Tonglo—Bhotan coolies run away—View of Chumulari—Nepal peaks to west—Sakkiazung—Buceros—Road to Wallanchoon—Oaks—Scarcity of water—Singular view of mountain-valleys—Encampment—My tent and its furniture—Evening occupations—Dunkotah—Cross ridge of Sakkiazung—Yews—Silver-firs—View of Tambur valley—Pemmi river—Pebbly terraces—Geology—Holy springs—Enormous trees—Luculia gratissima—Khawa river, rocks of—Arrive at Tambur—Shingle and gravel terraces—Natives, indolence of—Canoe ferry—Votive offerings—Bad road—Temperature, &c.—Chingtam village, view from—Mywa river and Guola—House—Boulders—Chain-bridge—Meepo, arrival of—Fevers.

OWING to the unsatisfactory nature of our relations with the Sikkim authorities, to which I have elsewhere alluded, my endeavours to procure leave to penetrate further beyond the

Darjeeling territory than Tonglo, were attended with some trouble and delay.

In the autumn of 1848, the Governor-General communicated with the Rajah, desiring him to grant me honourable and safe escort through his dominions; but this was at once met by a decided refusal, apparently admitting of no compromise. Pending further negociations, which Dr. Campbell felt sure would terminate satisfactorily, though perhaps too late for my purpose, he applied to the Nepal Rajah for permission for me to visit the Tibetan passes, west of Kinchinjunga; proposing in the meanwhile to arrange for my return through Sikkim. Through the kindness of Col. Thoresby, the Resident at that Court, and the influence of Jung Bahadoor, this request was promptly acceded to, and a guard of six Nepalese soldiers and two officers was sent to Darjeeling to conduct me to any part of the eastern districts of Nepal which I might select. I decided upon following up the Tambur, a branch of the Arun river, and exploring the two easternmost of the Nepalese passes into Tibet (Wallanchoon and Kanglachem), which would bring me as near to the central mass and loftiest part of the eastern flank of Kinchinjunga as possible.

For this expedition (which occupied three months), all the arrangements were undertaken for me by Dr. Campbell, who afforded me every facility which in his government position he could command, besides personally superintending the equipment and provisioning of my party. Taking horses or loaded animals of any kind was not expedient: the whole journey was to be performed on foot, and everything carried on men's backs. As we were to march through wholly unexplored countries, where food was only procurable at uncertain intervals, it was necessary to engage a large body of porters, some of whom should carry bags of rice for the coolies and themselves too. The difficulty of selecting these carriers, of whom thirty were required, was very great. The Lepchas, the best and most tractable, and over whom Dr. Campbell had the most direct influence, disliked employment out of Sikkim, especially in so warlike a country as Nepal: and they were besides thought unfit for the snowy regions. The Nepalese, of whom there are many residing as British subjects in Darjeeling, were mostly run-aways from their own country, and afraid of being claimed, should they return to it, by the lords of the soil. To employ Limboos, Moormis, Hindoos, or other natives of low elevations, was out of the question; and no course appeared advisable but to engage some of the Bhotan run-aways domiciled in Darjeeling, who are accustomed to travel at all eleva-

tions, and fear nothing but a return to the country which they have abandoned as slaves, or as culprits: they are immensely powerful, and though intractable to the last degree, are generally glad to work and behave well for money. The choice, as will hereafter be seen, was unfortunate, though at the time unanimously approved.

My party mustered fifty-six persons. These consisted of myself, and one personal servant, a Portuguese half-caste, who undertook all offices, and spared me the usual train of Hindoo and Mahometan servants. My tent and equipments (for which I was greatly indebted to Mr. Hodgson), instruments, bed, box of clothes, books and papers, required a man for each. Seven more carried my papers for drying plants, and other scientific stores. The Nepalese guard had two coolies of their own. My interpreter, the coolie Sirdar (or headman), and my chief plant collector (a Lepcha), had a man each. Mr. Hodgson's bird and animal shooter, collector, and stuffer, with their ammunition and indispensables, had four more; there were besides, three Lepcha lads to climb trees and change the plant-papers, who had long been in my service in that capacity; and the party was completed by fourteen Bhotan coolies laden with food, consisting chiefly of rice with ghee, oil, capsicum, salt, and flour.

I carried myself a small barometer, a large knife and digger for plants, note-book, telescope, compass and other instruments; whilst two or three Lepcha lads who accompanied me as satellites, carried a botanising box, thermometers, sextant and artificial horizon, measuring-tape, azimuth compass and stand geological hammer, bottles and boxes for insects, sketch-book, &c., arranged in compartments of strong canvas bags. The Nepal officer (of the rank of serjeant, I believe) always kept near me with one of his men, rendering innumerable little services. Other sepoys were distributed amongst the remainder of the party; one went ahead to prepare camping-ground, and one brought up the rear.

The course generally pursued by Himalayan travellers is to march early in the morning, and arrive at the camping-ground before or by noon, breakfasting before starting, or *en route*. I never followed this plan, because it sacrificed the mornings, which were otherwise profitably spent in collecting about camp; whereas, if I set off early, I was generally too tired with the day's march to employ in any active pursuit the rest of the daylight, which in November only lasted till 6 P.M. The men breakfasted early in the morning, I somewhat later, and all had started by 10 A.M., arriving between 4 and 6 P.M. at the next camping-ground. My

tent was formed of blankets, spread over cross-pieces of wood and a ridge-pole, enclosing an area of 6 to 8 feet by 4 to 6 feet. The bedstead, table, and chair were always made by my Lepchas, as described in the Tonglo excursion. The evenings I employed in writing up notes and journals, plotting maps, and ticketing the plants collected during the day's march.

I left Darjeeling at noon, on the 27th October, accompanied by Dr. Campbell, who saw me fairly off, the coolies having preceded me. Our direct route would have been over Tonglo, but the threats of the Sikkim authorities rendered it advisable to make for Nepal at once; we therefore kept west along the Goong ridge, a western prolongation of Sinchul.

On overtaking the coolies, I proceeded for six or seven miles along a zig-zag road, at about 7,500 feet elevation, through dense forests, and halted at a little hut within sight of Darjeeling. Rain and mist came on at nightfall, and though several parties of my servants arrived, none of the Bhotan coolies made their appearance, and I spent the night without food or bed, the weather being much too foggy and dark to send back to meet the missing men. They joined me late on the following day, complaining unreasonably of their loads, and without their Sirdar, who, after starting his crew, had returned to take leave of his wife and family. On the following day he appeared, and after due admonishment we started, but four miles further on were again obliged to halt for the Bhotan coolies, who were equally deaf to threats and entreaties. As they did not come up till dusk, we were obliged to encamp here (alt. 7,400 feet), at the common source of the Balasun, which flows to the plains, and the Little Rungeet, whose course is north.

The contrast between the conduct of the Bhotan men and that of the Lepchas and Nepalese was so marked, that I seriously debated in my own mind the propriety of sending the former back to Darjeeling, but yielded to the remonstrances of their Sirdar and the Nepal guard, who represented the great difficulty we should have in replacing them, and above all, the loss of time, at this season a matter of great importance. We accordingly started again the following morning, and still keeping in a western direction, crossed the posts in the forest dividing Sikkim from Nepal, and descended into the Myong valley of the latter country, through which flows the river of that name, a tributary of the Tambur. The Myong valley is remarkably fine: it runs south-west from Tonglo, and its open character and general fertility contrast strongly with the bareness of the lower mountain

spurs which flank it, and with the dense, gloomy, steep, and forest-clad gorges of Sikkim. At its lower end, about twenty miles from the frontier, is the military fort of Ilam, a celebrated stockaded post and cantonment of the Ghorkas: its position is marked by a conspicuous conical hill. The inhabitants are chiefly Brahmins, but there are also some Moormis, and a few Lepchas who escaped from Sikkim during the general massacre in 1825. Among these is a man who had formerly much influence in Sikkim; he still retains his title of Kazee,[1] and has had large lands assigned to him by the Nepalese Government: he sent the usual present of a kid, fowls, and eggs, and begged me to express to Dr. Campbell his desire to return to his native country, and settle at Darjeeling.

The scenery of this valley is the most beautiful I know of in the lower Himalaya, and the Cheer Pine (*P. longifolia*) is abundant, cresting the hills, which are loosely clothed with clumps of oaks and other trees, bamboos, and bracken (*Pteris*). The slopes are covered with red clay, and separate little ravines luxuriantly clothed with tropical vegetation, amongst which flow pebbly streams of transparent cool water. The villages, which are merely scattered collections of huts, are surrounded with fields of rice, buckwheat, and Indian corn, which latter the natives were now storing in little granaries, mounted on four posts, men, women, and children being all equally busy. The quantity of gigantic nettles (*Urtica heterophylla*) on the skirts of these maize fields is quite wonderful: their long white stings look most formidable, but though they sting virulently, the pain only lasts half an hour or so. These, however, with leeches, mosquitos, peepsas, and ticks, sometimes keep the traveller in a constant state of irritation.

However civilised the Hindoo may be in comparison with the Lepcha, he presents a far less attractive picture to the casual observer; he comes to your camping-ground, sits down, and stares with all his might, but offers no assistance; if he bring a present at all, he expects a return on the spot, and goes on begging till satisfied. I was amused by the cool way in which my Ghorka guard treated the village lads, when they wanted help in my service, taking them by the shoulder, pulling out their knives for them, placing them in their hands, and setting them to cut down a tree, or to chop firewood, which they seldom refused to do, when a little such douce violence was applied.

[1] This Mahometan title, by which the officers of state are known in Sikkim, is there generally pronounced Kajee.

My object being to reach the Tambur, north of the great east and west mountain ridge of Sakkiazung, without crossing the innumerable feeders of the Myong and their dividing spurs, we ascended the north flank of the valley to a long spur from Tonglo, intending to follow winding ridges of that mountain to the sources of the Pemmi at the Phulloot mountains, and thence descend.

On the 3rd November I encamped on the flank of Tonglo (called Nanki in Nepal), at 9,300 feet, about 700 feet below the western summit, which is rocky, and connected by a long flat ridge with that which I had visited in the previous May. The Bhotan coolies behaved worse than ever; their conduct being in all respects typical of the turbulent, mulish race to which they belong. They had been plundering my provisions as they went along, and neither their Sirdar nor the Ghorka soldiers had the smallest authority over them. I had hired some Ghorka coolies to assist and eventually to replace them, and had made up my mind to send back the worst from the more populous banks of the Tambur, when I was relieved by their making off of their own accord. The dilemma was however awkward, as it was impossible to procure men on the top of a mountain 10,000 feet high, or to proceed towards Phulloot. No course remained but to send to Darjeeling for others, or to return to the Myong valley, and take a more circuitous route over the west end of Sakkiazung, which led through villages from which I could procure coolies day by day. I preferred the latter plan, and sent one of the soldiers to the nearest village for assistance to bring the loads down, halting a day for that purpose.

From the summit of Tonglo I enjoyed the view I had so long desired of the Snowy Himalaya, from north-east to north-west; Sikkim being on the right, Nepal on the left, and the plains of India to the southward; and I procured a set of compass bearings, of the greatest use in mapping the country. In the early morning the transparency of the atmosphere renders this view one of astonishing grandeur. Kinchinjunga bore nearly due north, a dazzling mass of snowy peaks, intersected by blue glaciers, which gleamed in the slanting rays of the rising sun, like aquamarines set in frosted silver. From this the sweep of snowed mountains to the eastward was almost continuous as far as Chola (bearing east-north-east), following a curve of 150 miles, and enclosing the whole of the northern part of Sikkim, which appeared a billowy mass of forest-clad mountains. On the north-east horizon rose the Donkia mountain (23,176 feet), and

Chumulari (23,929). Though both were much more distant than the snowy ranges, being respectively eighty and ninety miles off, they reared their gigantic heads higher, seeming what they really were, by far the loftiest peaks next to Kinchinjunga; and the perspective of snow is so deceptive, that though 40 to 60 miles beyond, they appeared as though almost in the same line with the ridges they overtopped.

Of these mountains, Chumulari presents many attractions to the geographer, from its long disputed position, its sacred character, and the interest attached to it since Turner's mission to Tibet in 1783. It was seen and recognised by Dr. Campbell, and measured by Colonel Waugh, from Sinchul, and also from Tonglo, and was a conspicuous object in my subsequent journey to Tibet. Beyond Junnoo, one of the western peaks of Kinchinjunga, no continuous snowy chain was visible; the Himalaya seemed suddenly to decline into black and rugged peaks, till in the far north-west it rose again in a white mountain mass of stupendous elevation at 80 miles distance, called, by my Nepal people, "Tsungau."[1] From the bearings I took of it from several positions, it is in about lat. 27° 49′ and long. 86° 24′, and is probably on the west flank of the Arun valley and river, which latter, in its course from Tibet to the plains of India, receives the waters from the west flank of Kinchinjunga, and from the east flank of the mountain in question. It is perhaps one which has been seen and measured from the Tirhoot district by some of Colonel Waugh's party, and which has been reported to be upwards of 28,000 feet in elevation; and it is the only mountain of the first class in magnitude between Gosainthan (north-east of Katmandoo) and Kinchinjunga.

To the west, the black ridge of Sakkiazung, bristling with pines (*Abies Webbiana*), cut off the view of Nepal; but south-west, the Myong valley could be traced to its junction with the Tambur about thirty miles off: beyond which to the south-west and south, low hills belonging to the outer ranges of Nepal rose on the distant horizon, seventy or eighty miles off; and of these the most conspicuous were the Mahavarati which skirt the Nepal Terai. South and south-east, Sinchul and the Goong range of Sikkim intercepted the view of the plains of India, of which I had a distant peep to the south-west only.

[1] This is probably the easternmost and loftiest peak seen from Katmandoo, distant 78 miles, and estimated elevation 20,117 feet by Col. Crawford's observations. [P.S.—Tsungau is now better known as Mount Everest, the loftiest summit on the globe, 29,002 feet Its position is Lat. 28° N., Long. 87° E. It cannot be seen from Katmandoo.]

The west top of Tonglo is very open and grassy, with occasional masses of gneiss of enormous size, but probably not *in situ*. The whole of this flank, and for 1,000 feet down the spur to the south-west, had been cleared by fire for pasturage, where flocks of black-faced sheep were grazing. During my stay on the mountain, except in the early mountain, the weather was bleak, gloomy, and very cold, with a high south-west wind. The mean temperature was 41°, entremes $\frac{53°·2}{26°}$: the nights were very clear, with sharp hoar-frost; the radiating thermometer sank to 21°, the temperature at 3½ feet depth was 51°·5.

A few of the Bhotan coolies having voluntarily returned, I left Tonglo on the 5th, and descended its west flank to the Mai, a feeder of the Myong. The descent was as abrupt as that on the east face, but through less dense forest; the Sikkim side (that facing the east) being much the dampest. I encamped at dark by a small village (Jummanoo), at 4,360 feet, having descended 5,000 feet in five hours. Hence we marched eastward to the village of Sakkiazung, which we reached on the third day, crossing *en route* several spurs 4,000 to 6,000 feet high, from the same ridge, and as many rivers, which all fall into the Myong, and whose beds are elevated from 2,500 to 3,000 feet.

Though rich and fertile, the country is scantily populated, and coolies were procured with difficulty: I therefore sent back to Darjeeling all but absolute indispensables, and on the 9th of November started up the ridge in a northerly direction, taking the road from Ilam to Wallanchoon. The ascent was gradual, through a fine forest, full of horn-bills (*Buceros*), a bird resembling the Toucan ("Dhunass" Lepcha). At 7,000 feet an oak (*Quercus semecarpifolia*), "Khasrou" of the Nepalese, commences, a tree which is common as far west as Kashmir, but which I never found in Sikkim, though it appears again in Bhotan.[1] It forms a broad-headed tree, and has a very handsome appearance; its favourite locality is on grassy open shoulders of the mountains. It was accompanied by an *Astragalus*, *Geranium*, and several other plants of the drier interior parts of Sikkim. Water is very scarce along the ridge; we walked fully eight miles without finding any, and were at length obliged to camp at 8,350 feet by the only spring that we should be able to reach. With respect to drought, this ridge differs materially from Sikkim, where water abounds at all elevations; and the cause is obviously its position to the westward of the great ridge of Singalelah

[1] This oak ascends in the N. W. Himalaya to the highest limit of forest (12,000 feet). No oak in Sikkim attains a greater elevation than 10,000.

(including Tonglo) by which the S.W. currents are drained of their moisture. Here again, the east flank was much the dampest and most luxuriantly wooded.

While my men encamped on a very narrow ridge, I ascended a rocky summit, composed of great blocks of gneiss, from which I obtained a superb view to the westward. Immediately below a fearfully sudden descent, ran the Daomy River, bounded on the opposite side by another parallel ridge of Sakkiazung, enclosing, with that on which I stood, a gulf from 6,000 to 7,000 feet deep, of wooded ridges, which, as it were, radiated outwards as they ascended upwards in rocky spurs to the pine-clad peaks around. To the south-west, in the extreme distance, were the boundless plains of India, upwards of 100 miles off, with the Cosi meandering through them like a silver thread.

The firmament appeared of a pale steel blue, and a broad low arch spanned the horizon, bounded by a line of little fleecy clouds (moutons); below this the sky was of a golden yellow, while in successively deeper strata, many belts or ribbons of vapour appeared to press upon the plains, the lowest of which was of a dark leaden hue, the upper more purple, and vanishing into the pale yellow above. Though well defined, there was no abrupt division between the belts, and the lowest mingled imperceptibly with the hazy horizon. Gradually the golden lines grew dim, and the blues and purples gained depth of colour; till the sun set behind the dark-blue peaked mountains in a flood of crimson and purple, sending broad beams of grey shade and purple light up to the zenith, and all around. As evening advanced, a sudden chill succeeded, and mists rapidly formed immediately below me in little isolated clouds, which coalesced and spread out like a heaving and rolling sea, leaving nothing above its surface but the ridges and spurs of the adjacent mountains. These rose like capes, promontories, and islands, of the darkest leaden hue, bristling with pines, and advancing boldly into the snowy white ocean, or starting from its bed in the strongest relief. As darkness came on, and the stars arose, alight fog gathered round me, and I quitted with reluctance one of the most impressive and magic scenes I ever beheld.

Returning to my tent, I was interested in observing how well my followers had accommodated themselves to their narrow circumstances. Their fires gleamed everywhere among the trees, and the people, broken up into groups of five, presented an interesting picture of native, savage, and half-civilised life. I wandered amongst them in the darkness, and watched unseen

their operations; some were cooking, with their rude bronzed faces lighted up by the ruddy glow, as they peered into the pot, stirring the boiling rice with one hand, while with the other they held back their long tangled hair. Others were bringing water from the spring below, some gathering sprigs of fragrant *Artemisia* and other shrubs to form couches—some lopping branches of larger trees to screen them from nocturnal radiation; their only protection from the dew being such branches stuck in the ground, and slanting over their procumbent forms. The Bhotanese were rude and boisterous in their pursuits, constantly complaining to the Sirdars, and wrangling over their meals. The Ghorkas were sprightly, combing their raven hair, telling interminably long stories, of which money was the burthen, or singing Hindoo song through their noses in chorus; and being neater and better dressed, and having a servant to cook their food, they seemed quite the gentlemen of the party. Still the Lepcha was the most attractive, the least restrained, and the most natural in all his actions, the simplest in his wants and appliances, with a bamboo as his water-jug, an earthen pot as his kettle, and all manner of herbs collected during the day's march to flavour his food.

My tent was made of a blanket thrown over the limb of a tree; to this others were attached, and the whole was supported on a frame like a house. One half was occupied by my bedstead, beneath which was stowed my box of clothes, while my books and writing materials were placed under the table. The barometer hung in the most out-of-the-way corner, and my other instruments all around. A small candle was burning in a glass shade, to keep the draught and insects from the light, and I had the comfort of seeing the knife, fork, and spoon laid on a white napkin, as I entered my snug little house, and flung myself on the elastic couch to ruminate on the proceedings of the day, and speculate on those of the morrow, while waiting for my meal, which usually consisted of stewed meat and rice, with biscuits and tea. My thermometers (wet and dry bulb, and minimum) hung under a temporary canopy made of thickly plaited bamboo and leaves close to the tent, and the cooking was performed by my servant under a tree.

After dinner my occupations were to ticket and put away the plants collected during the day, write up journals, plot maps, and take observations till 10 P.M. As soon as I was in bed, one of the Nepal soldiers was accustomed to enter, spread his blanket on the ground, and sleep there as my guard. In the morning the collectors were sent to change the plant-papers, while I

explored the neighbourhood, and having taken observations and breakfasted, all were ready to start at 10 A.M.

Following the same ridge, after a few miles of ascent over much broken gneiss rock, the Ghorkas led me aside to the top of a knoll, 9,300 feet high, covered with stunted bushes, and commanding a splendid view to the west, of the broad, low, well cultivated valley of the Tambur, and the extensive town of Dunkotah on its banks, about twenty-five miles off; the capital of this part of Nepal, and famous for its manufactory of paper of the *Daphne*. Hence too I gained a fine view of the plains of India, including the course of the Cosi river, which, receiving the Arun and Tambur, debouches into the Ganges opposite Colgong (see p. 66).

A little further on we crossed the main ridge of Sakkiazung, a long flexuous chain stretching for miles to the westward from Phulloot on Singalelah, and forming the most elevated and conspicuous transverse range in this part of Nepal: its streams flow south to the Myong, and north to feeders of the Tambur. Silver firs (*Abies Webbiana*) are found on all the summits; but to my regret none occurred in our path, which led just below their limit (10,000 feet), on the southern Himalayan ranges. There were, however, a few yews, exactly like the English. The view that opened on cresting this range was again magnificent, of Kinchinjunga, the western snows of Nepal, and the valley of the Tambur winding amongst wooded and cultivated hills to a long line of black-peaked, rugged mountains, sparingly snowed, which intervene between Kinchinjunga and the great Nepal mountain before mentioned. The extremely varied colouring on the infinite number of hill-slopes that everywhere intersected the Tambur valley was very pleasing. For fully forty miles to the northward there were no lofty forest-clad mountains, nor any apparently above 4,000 to 5,000 feet: villages and hamlets appeared everywhere, wite crops of golden mustard and purple buckwheat in full flower; yellow rice and maize, green hemp, pulse, radishes, and barley, and brown millet. Here and there deep groves of oranges, the broad-leafed banana, and sugar-cane, skirted the bottoms of the valleys, through which the streams were occasionally seen, rushing in white foam over their rocky beds. It was a goodly sight to one who had for his only standard of comparison the view from Sinchul, of the gloomy forest-clad ranges of 6,000 to 10,000 feet, that intervene between that mountain and the snowy girdle of Sikkim; though I question whether a traveller from more favoured climes would see more in

this, than a thinly inhabited country, with irregular patches of poor cultivation, a vast amount of ragged forest on low hills of rather uniform height and contour, relieved by a dismal background of frowning black mountains, sprinkled with snow! Kinchinjunga was again the most prominent object to the north-east, with its sister peaks of Kubra (24,005 feet), and Junnoo (25,312 feet). All these presented bare cliffs for several thousand feet below their summits, composed of white rock with a faint pink tint:—on the other hand the lofty Nepal mountain in the far west presented cliffs of black rocks. From the summit two routes to the Tambur presented themselves; one, the main road, led west and south along the ridge, and then turned north, descending to the river; the other was shorter, leading abruptly down to the Pemmi river, and thence along its banks, west to the Tambur. I chose the latter.

The descent was very abrupt on the first day, from 9,500 feet to 5,000 feet, and on that following to the bed of the Pemmi, at 2,000 feet; and the road was infamously bad, generally consisting of a narrow, winding, rocky path among tangled shrubs and large boulders, brambles, nettles, and thorny bushes, often in the bed of the torrent, or crossing spurs covered with forest, round whose bases it flowed. A little cultivation was occasionally met with on the narrow flat pebbly terraces which fringed the stream, usually of rice, and sometimes of the small-leaved variety of hemp (*Cannabis*), grown as a narcotic.

The rocks above 5,000 feet were gneiss; below this, cliffs of very micaceous schist were met with, having a north-west strike, and being often vertical; the boulders again were always of gneiss. The streams seemed rather to occupy faults, than to have eroded courses for themselves; their beds were invariably rocky or pebbly, and the waters white and muddy from the quantity of alumina. In one little rocky dell the water gushed through a hole in a soft stratum in the gneiss; a trifling circumstance which was not lost upon the crafty Brahmins, who had cut a series of regular holes for the water, ornamented the rocks with red paint, and a row of little iron tridents of Siva, and dedicated the whole to Mahadeo.

In some spots the vegetation was exceedingly fine, and several large trees occurred: I measured a Toon (*Cedrela*) thirty feet in girth at five feet above the ground. The skirts of the forest were adorned with numerous jungle flowers, rice crops, blue *Acanthaceæ* and *Pavetta*, wild cherry-trees covered with scarlet blossoms, and trees of the purple and lilac *Bauhinia*; while

Thunbergia, *Convolvulus*, and other climbers, hung in graceful festoons from the boughs, and on the dry micaceous rocks the *Luculia gratissima*, one of our green-house ornaments, grew in profusion, its gorgeous heads of rose-coloured blossoms scenting the air.

At the junction of the Pemmi and Khawa rivers, there are high rocks of mica-slate, and broad river-terraces of stratified sand and pebbles, apparently alternating with deposits of shingle. On this hot, open expanse, elevated 2,250 feet, appeared many trees and plants of the Terai and plains, as pomegranate, peepul, and sal; with extensive fields of cotton, indigo, and irrigated rice.

We followed the north bank of the Khawa, which runs westerly through a gorge, between high cliffs of chlorite, containing thick beds of stratified quartz. At the angles of the river broad terraces are formed, fifteen to thirty feet above its bed, similar to those just mentioned, and planted with rows of *Acacia Serissa*, or laid out in rice fields, or sugar plantations.

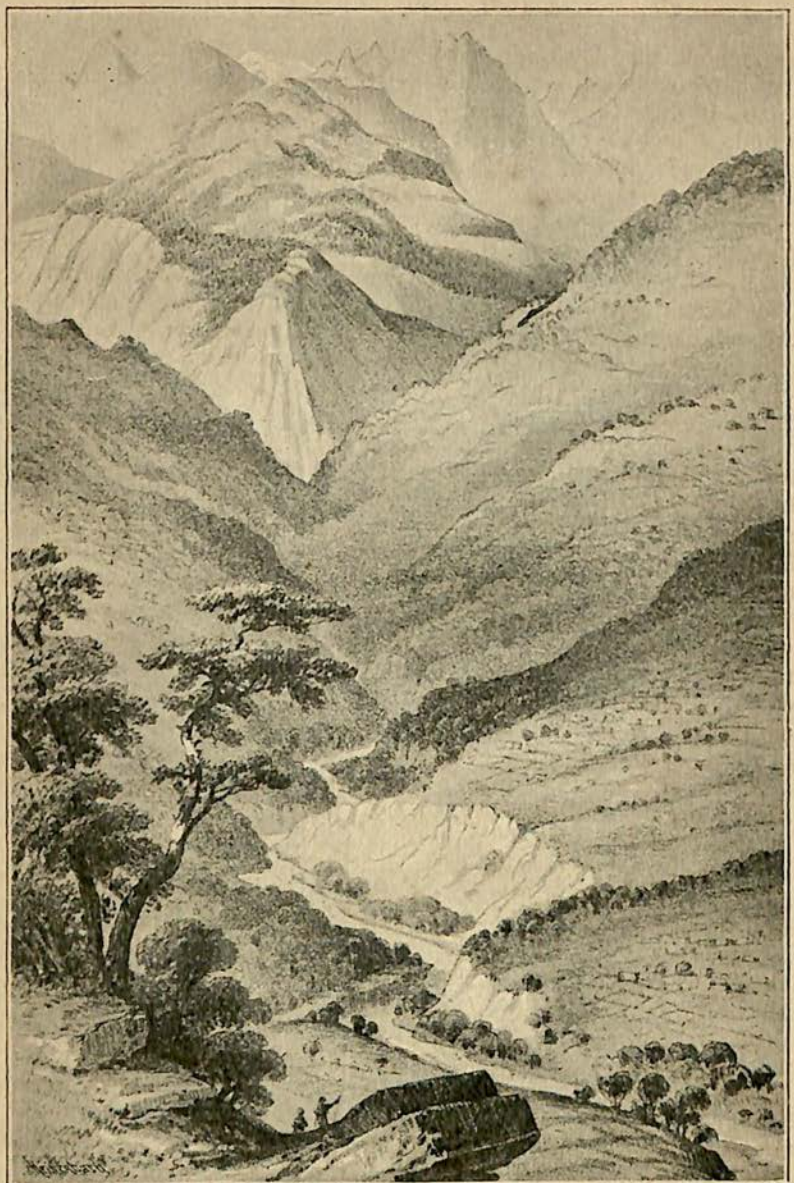
I reached the east bank of the Tambur, on the 13th of November, at its junction with the Khawa, in a deep gorge. It formed a grand stream, larger than the Teesta, of a pale, sea-green, muddy colour, and flowed rapidly with a strong ripple, but no foam; it rises six feet in the rains, but ice never descends nearly so low; its breadth was sixty to eighty yards, its temperature 55° to 58°. The breadth of the foaming Khawa was twelve to fifteen yards, and its temperature 56½°. The surrounding vegetation was entirely tropical, consisting of scrubby sal trees, acacia, *Grislea*, *Emblica*, *Hibiscus*, &c.; the elevation being but 1,300 feet, though the spot was twenty-five miles in a straight line from the plains. I camped at the fork of the rivers, on a fine terrace fifty feet above the water, about seventy yards long, and one hundred broad, quite flat-topped, and composed of shingle, gravel, &c., with enormous boulders of gneiss, quartz, and hornstone, much water-worn; it was girt by another broken terrace, twelve feet or so above the water, and covered with long grass and bushes.

The main road from Ilam to Wallanchoon, which I quitted on Sakkiazung, descends steeply on the opposite bank of the river, which I crossed in a canoe formed of a hollow trunk (of Toon), thirty feet long. There is considerable traffic along this road; and I was visited by numbers of natives, all Hindoos, who coolly squatted before my tent-door, and stared with their large black, vacant, lustrous eyes: they appear singularly indolent, and great beggars,

The land seems highly favoured by nature, and the population, though so scattered, is in reality considerable, the varied elevation giving a large surface; but the natives care for no more than will satisfy their immediate wants. The river swarms with fish, but they are too lazy to catch them, and they have seldom anything better to give or sell than sticks of sugar-cane, which when peeled form a refreshing morsel in these scorching marches. They have few and poor oranges, citrons, and lemons, very bad plantains, and but little else;—eggs, fowls, and milk are all scarce. Horned cattle are of course never killed by Hindoos, and it was but seldom that I could replenish my larder with a kid. Potatos are unknown, but my Sepoys often brought me large coarse radishes and legumes.

From the junction of the rivers the road led up the Tambur to Mywa Guola; about sixteen miles by the river, but fully thirty-five, as we wound, ascended, and descended, during three days' marches. We were ferried across the stream in a canoe much ruder than that of the New Zealander. I watched my party crossing by boat-loads of fifteen each; the Bhotan men hung little scraps of rags on the bushes before embarking,—the votive offerings of a Booddhist throughout central Asia;—the Lepcha, less civilised, scooped up a little water in the palm of his hand, and scattered it about, invoking the river god of his simple creed.

We always encamped upon gravelly terraces a few feet above the river, which flows in a deep gorge; its banks are very steep for 600 feet above the stream, though the mountains which flank it do not exceed 4,000 to 5,000 feet: this is a constant phenomenon in the Himalaya, and the roads, when low and within a few hundred feet of the river, are in consequence excessively steep and difficult; it would have been impossible to have taken ponies along that we followed, which was often not a foot broad, running along very steep cliffs, at a dizzy height above the river, and engineered with much trouble and ingenuity: often the bank was abandoned altogether, and we ascended several thousand feet to descend again. Owing to the steepness of these banks, and the reflected heat, the valley, even at this season, was excessively hot and close during the day, even when the temperature was below 70°, and tempered by a brisk breeze which rushes upwards from sunrise to sunset. The sun at this season does not, in many places, reach the bottom of these valleys until 10 A.M., and is off again by 3 P.M.; and the radiation to a clear sky is so powerful that dew frequently forms in the shade,



TAMBUR RIVER AND VALLEY (EAST NEPAL) FROM CHINGTAM (ELEVATION 5,000 FT.)
LOOKING NORTH.

throughout the day, and it is common at 10 A.M. to find the thermometer sink from 70° in a sheltered spot, dried by the sun, to 40° in the shade close by, where the sun has not yet penetrated. Snow never falls.

The rocks throughout this part of the river-course are mica-schists (strike north-west, dip south-west 70°, but very variable in inclination and direction); they are dry and grassy, and the vegetation wholly tropical, as is the entomology, which consists chiefly of large butterflies, *Mantis* and *Diptera*. Snowy mountains are rarely seen, and the beauty of the scenery is confined to the wooded banks of the main stream, which flows at an average inclination of fifty feet to the mile. Otters are found in the stream, and my party shot two, but could not procure them.

In one place the road ascended for 2,000 feet above the river, to the village of Chingtam, situated on a lofty spur of the west bank, whence I obtained a grand view of the upper course of the river, flowing in a tremendous chasm, flanked by well-cultivated hills, and emerging fifteen miles to the northward, from black mountains of savage grandeur, whose rugged, precipitous faces were streaked with snow, and the tops of the lower ones crowned with the tabular-branched silver-fir, contrasting strongly with the tropical luxuriance around. Chingtam is an extensive village, covering an area of two miles, and surrounded with abundant cultivation; the houses, which are built in clusters, are of wood, or wattle and mud, with grass thatch. The villagers, though an indolent, staring race, are quiet and respectable; the men are handsome, the women, though less so, often good-looking. They have fine cattle, and excellent crops.

Immediately above Chingtam, the Tambur is joined by a large affluent from the west, the Mywa, which is crossed by an excellent iron bridge, formed of loops hanging from two parallel chains, along which is laid a plank of sal timber. Passing through the village, we camped on a broad terrace, from sixty to seventy feet above the junction of the rivers, whose beds are 2,100 feet above the sea.

Mywa Guola (or bazaar) is a large village and mart, frequented by Nepalese and Tibetans, who bring salt, wool, gold, musk, and blankets, to exchange for rice, coral, and other commodities: and a custom-house officer is stationed there, with a few soldiers. The houses are of wood, and well built: the public ones are large, with verandahs, and galleries of carved wood; the workmanship is of Chinese character, and inferior to that of

Katmandoo; but in the same style, and quite unlike anything I had previously seen.

The river-terrace is in all respects similar to that at the junction of the Tambur and Khawa, but very extensive: the stones it contained were of all sizes, from a nut to huge boulders upwards of fifteen feet long, of which many strewed the surface, while others were in the bed of the river: all were of gneiss, quartz, and granite, and had doubtless been transported from great elevations, as the rocks *in situ*—both here and for several thousand feet higher up the river—were micaceous schists, dipping in various directions, and at all angles, with, however, a general strike to the north-west.

I was here overtaken by a messenger with letters from Dr. Campbell, announcing that the Sikkim Rajah had disavowed the refusal to the Governor-General's letter, and authorising me to return through any part of Sikkim I thought proper. The bearer was a Lepcha attached to the court: his dress was that of a superior person, bearing a scarlet jacket over a white cotton dress, the breadth of the blue stripes of which generally denotes wealth: he was accompanied by a sort of attaché, who wore a magnificent pearl and gold ear-ring, and carried his master's bow, as well as a basket on his back; while an attendant coolie bore their utensils and food. Meepo, or Teshoo (in Tibetan, Mr.), Meepo, as he was usually called, soon attached himself to me, and proved an active, useful, and intelligent companion, guide, and often collector, during many months afterwards.

The vegetation round Mywa Guola is still thoroughly tropical: the banyan is planted, and thrives tolerably, the heat being great during the day. Like the whole of the Tambur valley below 4,000 feet, and especially on these flats, the climate is very malarious before and after the rains; and I was repeatedly applied to by natives suffering under attacks of fever. During the two days I halted, the mean temperature was 60° (extremes $\frac{80}{41}$°), that of the Tambur, 53°, and of the Mywa, 56°; each varying a few degrees (the smaller stream the most) between sunrise and 4 P.M.: the sunk thermometer was 72°.

As we should not easily be able to procure food further on, I laid in a full stock here, and distributed blankets, &c., sufficient for temporary use for all the people, dividing them into groups or messes.

CHAPTER IX.

Leave Mywa—Suspension bridge—Landslips—Vegetation—Slope of river-bed—Bees' nests—Glacial phenomena—Tibetans, clothing, ornaments, amulets, salutation, children, dogs—Last Limboo village, Taptiatok—Beautiful scenery—Tibet village of Lelyp—*Opuntia*—*Edgeworthia*—Crab-apple—Chameleon and porcupine—Praying machine—*Abies Brunoniana*—European plants—Grand scenery—Arrive at Wallanchoon—Scenery around—Trees—Tibet houses—Manis and Mendongs—Tibet household—Food—Tea-soup—Hospitality—Yaks and Zobo, uses and habits of—Bhoteeas—Yak-hair tents—Guobah of Walloong—Jhatamansi—Obstacles to proceeding—Climate and weather—Proceed—Rhododendrons, &c.—Lichens—*Poa annua* and Shepherd's purse—Tibet camp—Tuquoroma—Scenery of pass—Glaciers and snow—Summit—Plants, wooly, &c.

ON the 18th November, we left Mywa Guola, and continued up the river to the village of Wallanchoon or Walloong, which was reached in six marches. The snowy peak of Junnoo (alt. 25,312 feet) forms a magnificent feature from this point, seen up the narrow gorge of the river, bearing N.N.E. about thirty miles. I crossed the Mewa, an affluent from the north, by another excellent suspension bridge. In these bridges, the principal chains are clamped to rocks on either shore, and the suspended loops occur at intervals of eight to ten feet; the single sal-plank laid on these loops swings terrifically, and the handrails not being four feet high, the sense of insecurity is very great.

The Wallanchoon road follows the west bank, but the bridge above having been carried away, we crossed by a plank, and proceeded along very steep banks of decomposed chlorite schist, much contorted, and very soapy, affording an insecure footing, especially where great landslips had occurred, which were numerous, exposing acres of a reddish and white soil of felspathic clay, sloping at an angle of 30°. Where the angle was less than 15°, rice was cultivated, and partially irrigated. The lateral streams (of a muddy opal green) had cut beds 200 feet deep in the soft earth, and were very troublesome to cross, from the crumbling cliffs on either side, and their broad swampy channels.

Five or six miles above Mywa, the valley contracts much, and the Tambur (whose bed is elevated about 3,000 feet) becomes a turbulent river, shooting along its course with immense velocity, torn into foam as it lashes the spurs of rock that flank it, and the enormous boulders with which its bed is strewn.[1] From this

[1] In some places torrents of stone were carried down by landslips, obstructing the rivers; when in the beds of streams, they were often cemented by felspathic clay into a hard breccia of angular quartz, gneiss, and felspar nodules.

elevation to 9,000 feet, its sinuous track extends about thirty miles, which gives the mean fall of 200 feet to the mile, quadruple of what it is for the lower part of its course. So long as its bed is below 5,000 feet, a tropical vegetation prevails in the gorge and along the terraces, consisting of tall bamboo, *Bauhinia*, *Acacia*, *Melastoma*, &c.; but the steep mountain sides above are either bare and grassy, or cliffs with scattered shrubs and trees, and their summits are of splintered slaty gneiss, bristling with pines: those faces exposed to the south and east are invariably the driest and most grassy, while the opposite are well wooded. *Rhododendron arboreum* becomes plentiful at 5,000 to 6,000 feet, forming a large tree on dry clayey slopes; it is accompanied by *Indigofera*, *Andromeda*, *Spiræa*, shrubby *Compositæ*, and very many plants absent at similar elevations on the wet outer Darjeeling ranges.

In the contracted parts of the valley, the mountains often dip to the river-bed, in precipices of gneiss, under the ledges of which wild bees build pendulous nests, looking like huge bats suspended by their wings; they are two or three feet long, and as broad at the top, whence they taper downwards: the honey is much sought for, except in spring, when it is said to be poisoned by Rhododendron flowers, just as that, eaten by the soldiers in the retreat of the Ten Thousand, was by the flowers of the *R. ponticum*.

Above these gorges are enormous accumulations of rocks, especially at the confluence of lateral valleys, where they rest upon little flats, like the river-terraces of Mywa, but wholly formed of angular shingle, flanked with beds of river-formed gravel: some of these boulders were thirty or forty yards across, and split as if they had fallen from a height; the path passing between the fragments.[1] At first I imagined that they had been precipitated from the mountains around; and I referred the shingle to landshoots, which during the rains descend several thousand feet in devastating avalanches, damming up the rivers, and destroying houses, cattle, and cultivation; but though I still refer the materials of many such terraces to this cause, I consider those at the mouths of valleys to be due to ancient glacial action, especially when laden with such enormous blocks as are probably ice-transported.

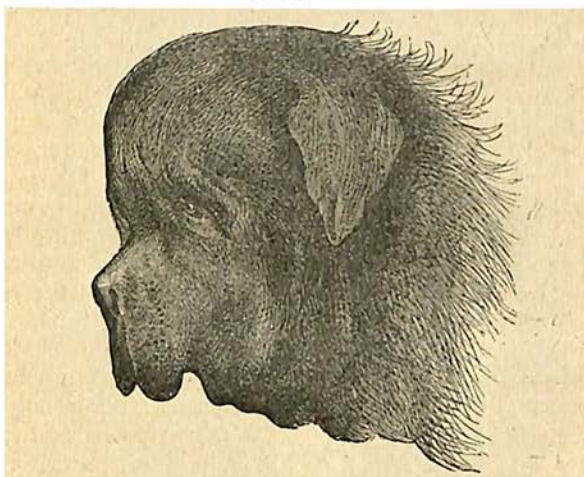
[1] The split fragments I was wholly unable to account for, till my attention was directed by Mr. Darwin to the observations of Charpentier and Agassiz, who refer similar ones met with in the Alps to rocks which have fallen through crevasses in glaciers.—See "Darwin on Glaciers and Transported Boulders in North Wales." London, "Phil. Mag." xxi. p. 180.

A change in the population accompanies that in the natural features of the country, Tibetans replacing the Limboos and Khass-tribes of Nepal, who inhabit the lower region. We daily passed parties of ten or a dozen Tibetans, on their way to Mywa Guola, laden with salt; several families of these wild, black, and uncouth-looking people generally travelling together. The men are middle-sized, often tall, very square-built and muscular; they have no beard, moustache, or whiskers, the few hairs on their faces being carefully removed with tweezers. They are dressed in loose blanket robes, girt about the waist with a leather belt, in which they place their iron or brass pipes, and from which they suspend their long knives, chopsticks, tobacco-pouch, tweezers, tinder-box, &c. The robe, boots, and cap are grey, or striped with bright colours, and they wear skull-caps, and the hair plaited into a pig-tail.

The women are dressed in long flannel petticoats and spencer, over which is thrown a sleeveless, short striped cloak, drawn round the waist by a girdle of broad brass or silver links, to which hang their knives, scissors, needle-cases, &c., and with which they often strap their children to their backs; the hair is plaited in two tails, and the neck loaded with strings of coral and glass beads, and great lumps of amber, glass, and agate. Both sexes wear silver rings and ear-rings, set with turquoises, and square amulets upon their necks and arms, which are boxes of gold or silver, containing small idols, or the nail-parings, teeth, or other reliques of some sainted Lama, accompanied with musk, written prayers, and other charms. All are good- humoured and amiable-looking people, very square and Mongolian in countenance, with broad mouths, high cheek-bones, narrow, upturned eyes, broad, flat noses, and low foreheads. White is their natural colour, and rosy cheeks are common amongst the younger women and children, but all are begrimed with filth and smoke; added to which, they become so weather-worn from exposure to the most rigorous climate in the world, that their natural hues are rarely to be recognised. Their customary mode of saluting one another is to loll out the tongue, grin, nod, and scratch their ear; but this method entails so much ridicule in the low countries, that they do not practise it to Nepalese or strangers; most of them when meeting me, on the contrary, raised their hands to their eyes, threw themselves on the ground, and kotowed most decorously, bumping their foreheads three times on the ground; even the women did this on several occasions. On rising, they begged for a bucksheesh, which I gave in tobacco or snuff, of which they

are immoderately fond. Both men and women constantly spin wool as they travel.

These motley groups of Tibetans are singularly picturesque, from the variety in their parti-coloured dresses, and their odd appearance. First comes a middle-aged man or woman, driving a little silky black yak, grunting under his load of 260 lb. of salt, besides pots, pans, and kettles, stools, churn, and bamboo vessels, keeping up a constant rattle, and perhaps, buried amongst all, a rosy-cheeked and lipped baby, sucking a lump of cheese-curd. The main body follow in due order, and you are soon entangled amidst sheep and goats, each with its two little bags of salt: beside these, stalks the huge, grave, bull-headed mastiff, loaded



TIBET MASTIFF.

like the rest, his glorious bushy tail thrown over his back in a majestic sweep, and a thick collar of scarlet wool round his neck and shoulders, setting off his long silky coat to the best advantage; he is decidedly the noblest-looking of the party, especially if a fine and pure black one, for they are often very ragged, dun-coloured, sorry beasts. He seems rather out of place, neither guarding nor keeping the party together, but he knows that neither yaks, sheep, nor goats, require his attention; all are perfectly tame, so he takes his share of work as salt-carrier by day, and watches by night as well. The children bring up the rear, laughing and chatting together; they, too, have their loads, even to the youngest that can walk alone.

The last village of the Limboos, Taptiatok, is large, and occupies a remarkable amphitheatre, apparently a lake-bed, in the course of the Tambur. After proceeding some way through a narrow gorge, along which the river foamed and roared, the sudden opening out of this broad, oval expanse, more than a mile long, was very striking: the mountains rose bare and steep, the west flank terminating in shivered masses of rock, while that on the right was more undulating, dry, and grassy: the surface was a flat gravel-bed, through which meandered the rippling stream, fringed with alder. It was a beautiful spot, the clear, cool, murmuring river, with its rapids and shallows, forcibly reminding me of trout-streams in the highlands of Scotland.

Beyond Taptiatok we again crossed the river, and ascended over dry, grassy, or rocky spurs to Lelyp, the first Bhoteea village; it stands on a hill fully 1,000 feet above the river, and commands a splendid view up the Yalloong and Kambachen valleys, which open immediately to the east, and appear as stupendous chasms in the mountains leading to the perpetual snows of Kinchinjunga. There were about fifty houses in the village, of wood and thatch, neatly fenced in with wattle, the ground between being carefully cultivated with radishes, buckwheat, wheat, and millet. I was surprised to find in one enclosure a fine healthy plant of *Opuntia*, in flower, at this latitude and elevation. A Lama, who is the head man of the place, came out to greet us, with his family and a whole troop of villagers; they were the same class of people as I have elsewhere described as Cis-nivean Tibetans, or Bhoteeas; none had ever before seen an Englishman, and I fear they formed no flattering opinion from the specimen now presented to them, as they seemed infinitely amused at my appearance, and one jolly dame clapped her hands to her sides, and laughed at my spectacles, till the hills echoed.

Elæagnus was common here, with *Edgeworthia Gardneri*,[1] a beautiful shrub, with globes of waxy, cowslip-coloured, deliciously scented flowers; also a wild apple, which bears a small austere fruit, like the Siberian crab. In the bed of the river rice was still cultivated by Limboos, and sub-tropical plants continued. I saw, too, a chameleon and a porcupine, indicating much warmth, and seeming quite foreign to the heart of these stupendous mountains. From 6,000 to 7,000 feet, plants of the temperate regions blend with the tropical; such as rhododendron, oak, ivy,

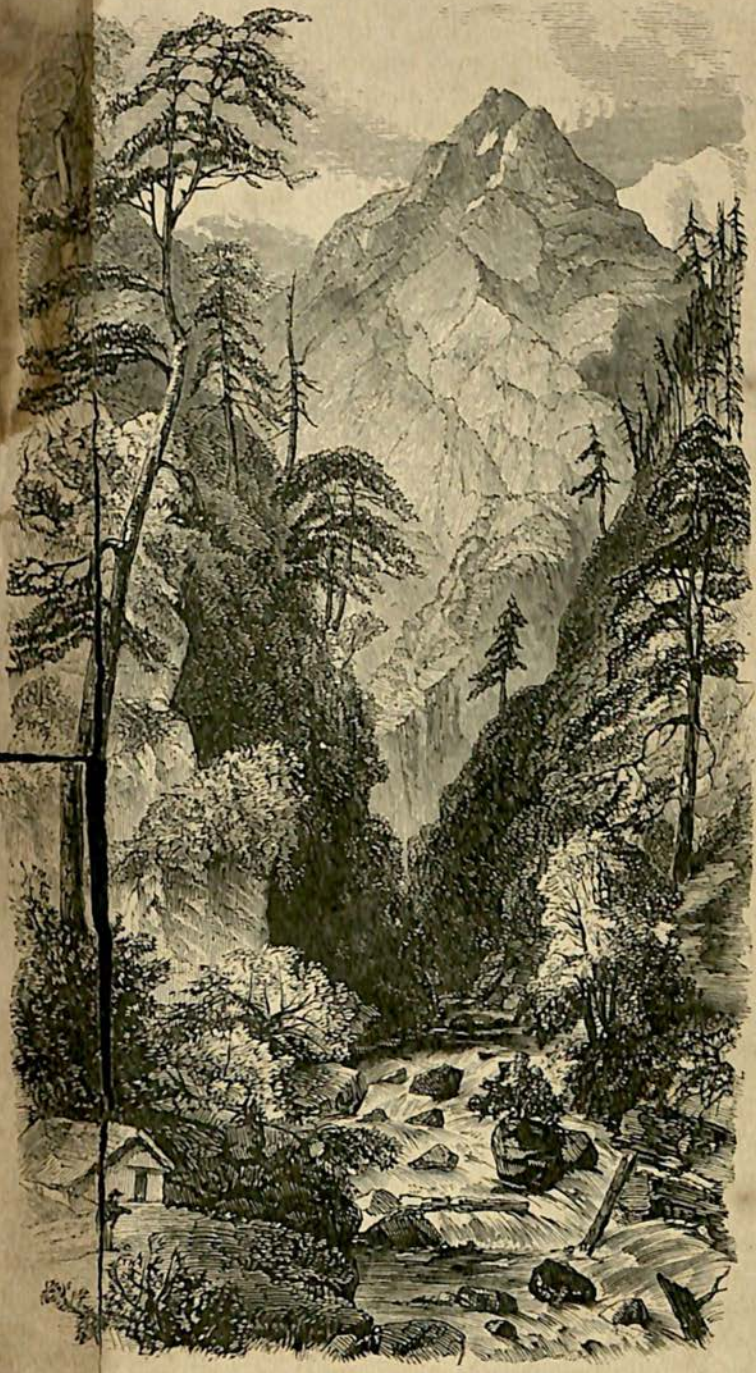
[1] A plant allied to *Daphne*, from whose bark the Nepal paper is manufactured. It was named after the eminent Indian botanist, brother of the late Miss Edgeworth.

geranium, berberry, clematis, and shrubby *Vaccinia*, which all made their appearance at Loongtoong, another Bhoteea village. Here, too, I first saw a praying machine, turned by water; it was enclosed in a little wooden house, and consisted of an upright cylinder containing a prayer, and with the words, "Om mani padmi om" (Hail to him of the Lotus and Jewel), painted on the circumference: it was placed over a stream, and made to rotate on its axis by a spindle which passed through the floor of the building into the water, and was terminated by a wheel.

Above this the road followed the west bank of the river; the latter was a furious torrent, flowing through a gorge, fringed with a sombre vegetation, damp, and dripping with moisture, and covered with long *Usnea* and pendulous mosses. The road was very rocky and difficult, sometimes leading along bluff faces of cliffs by wooden steps and single rotten planks. At 8,000 feet I met with pines, whose trunks I had seen strewing the river for some miles lower down: the first that occurred was *Abies Brunoniana*, a beautiful species, which forms a stately blunt pyramid, with branches spreading like the cedar, but not so stiff, and drooping gracefully on all sides. It is unknown on the outer ranges of Sikkim, and in the interior occupies a belt about 1,000 feet lower than the silver fir (*A. Webbiana*). Many sub-alpine plants occur here, as *Leycesteria*, *Thalictrum*, rose, thistles, alder, birch, ferns, berberry, holly, anemone, strawberry, raspberry, *Gnaphalium*, the alpine bamboo, and oaks. The scenery is as grand as any pictured by Salvator Rosa; a river roaring in sheets of foam, sombre woods, crags of gneiss, and tier upon tier of lofty mountains flanked and crested with groves of black firs, terminating in snow-sprinkled rocky peaks.

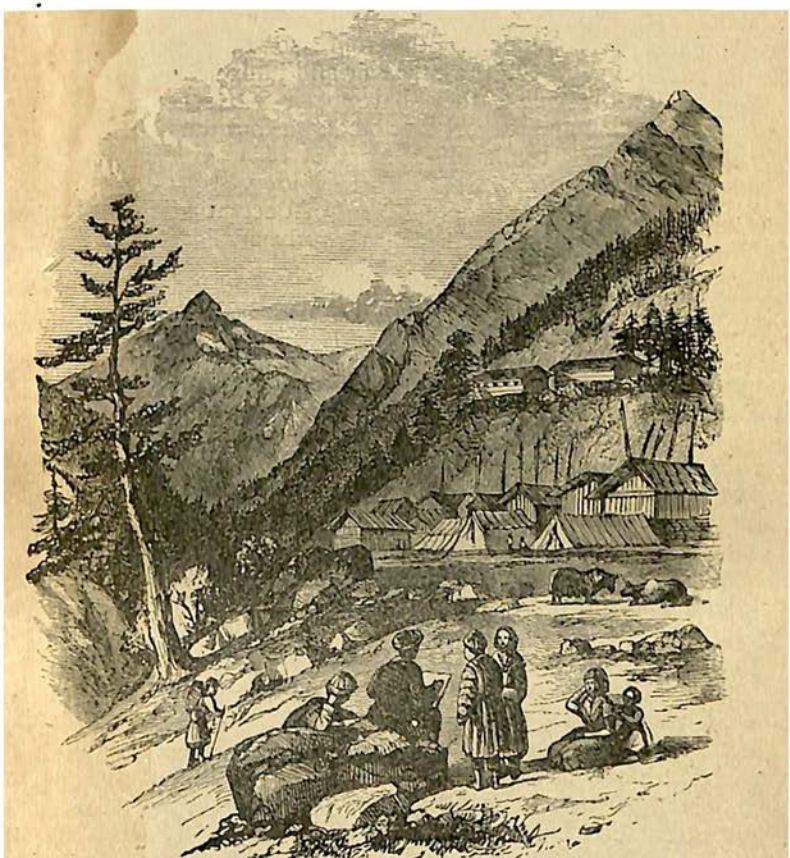
I now found the temperature getting rapidly cooler, both that of the air, which here at 8,066 feet fell to 32° in the night, and that of the river, which was always below 40°. It was in these narrow valleys only, that I observed the return cold current rushing down the river-courses during the nights, which were usually brilliant and very cold, with copious dew: so powerful, indeed, was the radiation, that the upper blanket of my bed became coated with moisture, from the rapid abstraction of heat by the frozen tarpaulin of my tent.

The rivers here are often fringed by flats of shingle, on which grow magnificent yews and pines; some of the latter were from from 120 to 150 feet high, and had been blown down, owing to their scanty hold on the soil. I measured one, *Abies Brunoniana*, twenty feet in girth. Many alpine rhododendrons occur at 9,000



TAMBUR RIVER AT THE LOWER LIMIT OF PINES.

feet, with *Astragalus* and creeping Tamarisk. Three miles below Wallanchoon the river forks, being met by the Yangma from the north-east; they are impetuous torrents of about equal volume; the Tambur especially (here called the Walloong) is often broken into cascades, and cuts a deep gorge-like channel.



WALLANCHOON VILLAGE.

I arrived at the village of Wallanchoon on the 23rd of November. It is elevated 10,385 feet, and situated in a fine open part of the Tambur valley, differing from any part lower down in all its natural features, being broad, with a rapid but not turbulent

stream, very grassy, and both the base and the sides of the flanking mountains covered with luxuriant dense bushes of rhododendron, rose, berberry, and juniper. Red-legged crows, hawks, wild pigeons, and finches, abounded. There was but little snow on the mountains around, which are bare and craggy above, but sloping below. Bleak and forbidding as the situation of any Himalayan village at 10,000 feet elevation must be, that of Wallanchoon is rendered the more so from the comparatively few trees; for though the silver fir and juniper are both abundant higher up the valley, they have been felled here for building materials, fuel, and export to Tibet. From the naked limbs and tall gaunt black trunks of those that remain, stringy masses of bleached lichen (*Usnea*) many feet long, stream in the wind. Both men and women seem fond of decorating their hair with wreaths of this lichen, which they dye yellow with leaves of *Symplocos*.

The village is very large, and occupies a flat on the east bank of the river, covered with huge boulders; the ascent to it is extremely steep, probably over an ancient moraine, though I did not recognise it as such at the time. Cresting this, the valley at once opens, and I was almost startled with the sudden change from a gloomy gorge to a broad flat and a populous village of large and good painted wooden houses, ornamented with hundreds of long poles and vertical flags, looking like the fleet of some foreign port; while a swarm of good-natured, intolerably dirty Tibetans were kotowing to me as I advanced.

The houses crept up the base of the mountain, on the flank of which was a very large, long convent, two-storied, and painted scarlet; with a low black roof, and backed by a grove of dark junipers; while the hill-sides around were thickly studded with bushes of deep green rhododendron, scarlet berberry, and withered yellow rose. The village contained about one hundred houses, irregularly crowded together, from twenty to forty feet high, and forty to eighty feet long; each accommodating several families. All were built of upright strong pine-planks, the interstices of which were filled with yak-dung; and they sometimes rest on a low foundation wall: the door was generally at the gable end; it opened with a latch and string, and turned on a wooden pivot; the only window was a slit closed by a shutter; and the roofs were very low-pitched, covered with shingles kept down by stones. The paths were narrow and filthy; and the only public buildings besides the convents were Manis and Mendongs; of these the former are square-roofed temples,

containing rows of praying-cylinders placed close together, from four to six feet high, and gaudily painted; some are turned by hand, and others by water: the latter are walls ornamented with slabs of clay and mica slate, with "Om Mani Padmi om" well carved on them in two characters, and repeated *ad infinitum*.

A Tibetan household is very slovenly; the family live higgledy-piggeldy in two or more apartments, the largest of which has an open fire on the earth, or on a stone if the floor be of wood. The pots and tea-pot are earthen and copper; and these, with the bamboo churn for the brick tea, some wooden and metal spoons, bowls, and platters, comprise all the kitchen utensils.

Every one carries in the breast of his robe a little wooden cup for daily use; neatly turned from the knotted roots of maple (see p. 90). The Tibetan chiefly consumes barley, wheat, or buck-wheat meal—the latter is confined to the poorer classes—with milk, butter, curd, and parched wheat; fowls, eggs, pork, and yak flesh when he can afford it, and radishes, a few potatos, legumes, and turnips in their short season. His drink is a sort of soup made from brick tea, of which a handful of leaves is churned up with salt, butter, and soda, then boiled and transferred to the tea-pot, whence it is poured scalding hot into each pot, which the good woman of the house keeps incessantly replenishing, and urging you to drain. Sometimes, but more rarely, the Tibetans make a drink by pouring boiling water over malt, as the Lepchas do over millet. A pipe of yellow mild Chinese tobacco generally follows the meal; more often, however, their tobacco is brought from the plains of India, when it is of a very inferior description. The pipe, carried in the girdle, is of brass or iron, often with an agate, amber, or bamboo mouth-piece.

Many herds of fine yaks were grazing about Wallanchoon: there were a few ponies, sheep, goats, fowls, and pigs, but very little cultivation except turnips, radishes, and potatos. The yak is a very tame, domestic animal, often handsome, and a true bison in appearance; it is invaluable to these mountaineers from its strength and hardiness, accomplishing, at a slow pace, twenty miles a day, bearing either two bags of salt or rice, or four to six planks of pinewood slung in pairs along either flank. Their ears are generally pierced, and ornamented with a tuft of scarlet worsted; they have large and beautiful eyes, spreading horns, long silky black hair, and grand bushy tails: black is their prevailing colour, but red, dun, parti-coloured, and white are common. In winter, the flocks graze below 8,000 feet, on account of the

great quantity of snow above that height; in summer they find pasturage as high as 17,000 feet, consisting of grass and small tufted *Carices*, on which they browse with avidity.

The zobo, or cross between the yak and hill cow (much resembling the English cow), is but rarely seen in these mountains, though common in the North West Himalaya. The yak is used as a beast of burden; and much of the wealth of the people consists in its rich milk and curd, eaten either fresh or dried, or powdered into a kind of meal. The hair is spun into ropes, and woven into a covering for their tents, which is quite pervious to wind and rain;[1] from the same material are made the gauze shades for the eyes used in crossing snowy passes. The bushy tails form the well-known "chowry" or fly-flapper of the plains of India; the bones and dung serve for fuel. The female drops one calf in April; and the young yaks are very full of gambols, tearing up and down the steep grassy and rocky slopes: their flesh is delicious, much richer and more juicy than common veal; that of the old yak is sliced and dried in the sun, forming jerked meat, which is eaten raw, the scanty proportion of fat preventing its becoming very rancid, so that I found it palatable food: it is called *schat-tcheu* (dried meat). I never observed the yak to be annoyed by any insects; indeed at the elevation it inhabits, there are no large diptera, bots, or gadflies to infest it. It loves steep places, delighting to scramble among rocks, and to sun its black hide perched on the glacial boulders which strew the Wallanchoon flat, on which these beasts always sleep. Their average value is from two to three pounds, but the price varies with the season. In autumn, when her calf is killed for food, the mother will yield no milk, unless the herdsman give it the calf's foot to lick, or lays a stuffed skin before it, to fondle, which it does with eagerness, expressing its satisfaction by short grunts, exactly like those of a pig, a sound which replaces the low uttered by ordinary cattle. The yak, though indifferent to ice and snow and to changes of temperature, cannot endure hunger so long as the sheep, nor pick its way so well upon stony ground. Neither can it bear damp heat, for which reason it will not live in summer below 7,000 feet, where liver disease carries it off after a very few years.[2] Lastly,

[1] The latter is, however, of little consequence in the dry climate of Tibet.

[2] Nevertheless, the yak seems to have survived the voyage to England. I find in Turner's "Tibet" (p. 189), that a bull sent by that traveller to Mr. Hastings reached England alive, and after suffering from languor, so far recovered its health and vigour as to become the father of many calves. Turner does not state by what mother these calves were born, an important omission, as he adds that all these died but one cow, which bore a calf by an

the yak is ridden, especially by the fat Lamas, who find its shaggy coat warm, and its paces easy; under these circumstances it is always led. The wild yak or bison (D'hong) of Central Asia, the superb progenitor of this animal, is the largest native animal of Tibet, in various parts of which country it is found; and the Tibetans say, in reference to its size, that the liver is a load for a tame yak. The Sikkim Dewan gave Dr. Campbell and myself an animated account of the chase of this animal, which is hunted by large dogs, and shot with a blunderbuss: it is untameable and horridly fierce, falling upon you with horns and chest, and if he rasps you with his tongue, it is so rough as to scrape the flesh from the bones. The horn is used as a drinking-cup in marriage feasts, and on other grand occasions. My readers are probably familiar with Messrs. Huc and Gabet's account of a herd of these animals being frozen fast in the head-waters of the Yangtsekiang river. There is a noble specimen in the British Museum not yet set up, and another is preparing for exhibition in the Crystal Palace at Sydenham.

The inhabitants of these frontier districts belong to two very different tribes, but all are alike called Bhoteeas (from Bhote, the proper name of Tibet), and have for many centuries been located in what is—in climate and natural features—a neutral ground between dry Tibet Proper, and the wet Himalayan gorges. They inhabit a climate too cold for either the Lepcha or Nepalese, migrating between 6,000 and 15,000 feet with the seasons, always accompanied by their herds. In all respects of appearance, religion, manners, customs, and language, they are Tibetans and Lama Booddhists, but they pay tax to the Nepal and Sikkim Rajahs, to whom they render immense service by keeping up and facilitating the trade in salt, wool, musk, &c., which could hardly be conducted without their co-operation. They levy a small tax on all imports, and trade a little on their own account, but are generally poor and very indolent. In their alpine summer quarters they grow scanty crops of wheat, barley, turnips, and radishes; and at their winter quarters, as at Loongtoong, the better classes cultivate fine crops of buck-wheat, millet, spinach, &c.; though seldom enough for their support, as in spring they are obliged to buy rice from the inhabitants of the lower regions. Equally

Indian bull. A painting of the yak (copied into Turner's book) by Stubbs, the animal painter, may be seen in the Museum of the Royal College of Surgeons, London. The artist is probably a little indebted to description for the appearance of its hair in a native state, for it is represented much too even in length, and reaching to too uniform a depth from the flanks.

dependent on Nepal and Tibet, they naturally hold themselves independent of both; and I found that my roving commission from the Nepal Rajah was not respected, and the guard of Ghorkas held very cheap.

On my arrival at Wallanchoon, I was conducted to two tents, each about eight feet long, of yak's hair, striped blue and white, which had been placed close to the village for my accommodation. Though the best that could be provided, and larger than my own, they were wretched in the extreme, being of so loose a texture that the wind blew through them: each was formed of two cloths with a long slit between them, that ran across the top, giving egress to the smoke, and ingress to the weather: they were supported on two short poles, kept to the ground by large stones, and fastened by yak's hair ropes. A fire was smoking vigorously in the centre of one, and some planks were laid at the end for my bed. A crowd of people soon came to stare and loll out their tongues at me, my party, and travelling equipage; though very civil, and only offensive in smell, they were troublesome, from their eager curiosity to see and handle everything; so that I had to place a circle of stones round the tents, whilst a soldier stood by, on the alert to keep them off. A more idle people are not to be found, except with regard to spinning, which is their constant occupation, every man and woman carrying a bundle of wool in the breast of their garments, which is spun by hand with a spindle, and wound off on two cross-pieces at its lower end. Spinning, smoking, and tea-drinking are their chief pursuits; and the women take all the active duties of the dairy and house. They live very happily together, fighting being almost unknown.

Soon after my arrival I was waited on by the Guobah (or headman), a tall, good-looking person, dressed in a purple woollen robe, with good pearl and coral ear and finger-rings, and a broad ivory ring over the left thumb,[1] as a guard when using the bow; he wore a neat thick white felt cap, with the border turned up, and a silk tassel on the top; this he removed with both hands and held before him, bowing three times on entering. He was followed by a crowd, some of whom were his own people, and brought a present of a kid, fowls, rice, and eggs, and some spikenard roots (*Nardostachys Jatamansi*, a species of valerian smelling strongly of patchouli), which is a very favourite perfume. After paying some compliments, he showed me round the village. During my walk, I found that I had a good many objections to

[1] A broad ring of this material, agate, or chalcedony, is a mark of rank here, as amongst the Man-choos, and throughout Central Asia.

overrule before I could proceed to the Wallanchoon pass, nearly two days' journey to the northward. In the first place, the Guobah disputed the Nepal Rajah's authority to pass me through his dominions; and besides the natural jealousy of these people when intruded upon, they have very good reasons for concealing the amount of revenue they raise from their position, and for keeping up the delusion that they alone can endure the excessive climate of these regions, or undergo the hardships and toil of the salt trade. My passport said nothing about the passes; my people, and especially the Ghorkas, detested the keen, cold, and cutting wind; at Mywa Guola, I had been persuaded by the Havildar to put off providing snow-boots and blankets, on the assurance that I should easily get them at Walloong, which I now found all but impossible, owing to there being no bazaar. My provisions were running short, and for the same reason I had no present hope of replenishing them. All my party had, I found, reckoned with certainty that I should have had enough of this elevation and weather by the time I reached Walloong. Some of them fell sick; the Guobah swore that the passes were full of snow, and had been impracticable since October; and the Ghorka Havildar respectfully deposed that he had no orders relative to the pass. Prompt measures were requisite, so I told all my people that I should stop the next day at Walloong, and proceed on the following on a three days' journey to the pass, with or without the Guobah's permission. To the Ghorka soldiers I said that the present they would receive, and the character they would take to their commandant, depended on their carrying out this point, which had been fully explained before starting. My servants I told that their pay and reward also depended on their implicit obedience. I took the Guobah aside and showed him troops of yaks (tethered by halters and toggles to a long rope stretched between two rocks), which had that morning arrived laden with salt from the north; I told him it was vain to try and deceive me; that my passport was ample, and that I should expect a guide, provisions, and snow-boots the next day; and that every impediment and every facility should be reported to the rajah.

During my two days' stay at Walloong, the weather was bitterly cold: as heretofore, the nights and mornings were cloudless, but by noon the whole sky became murky, the highest temperature (50°) occurring at 10 A.M. At this season the prospect from this elevation (10,385 feet) was dreary in the extreme; and the quantity of snow on the mountains, which was continually increasing, held out a dismal promise for my chance of exploring

lofty uninhabited regions. All annual and deciduous vegetation had long past, and the lofty Himalayas are very poor in mosses and lichens, as compared with the European Alps, and arctic regions in general. The temperature fluctuated from 22° at sunrise, to 50° at 10 A.M.; the mean being 35°;[1] one night it fell to 6¼°. Throughout the day, a south wind blew strong and cold up the valley, and at sunset was replaced by a keen north blast, searching every corner, and piercing through tent and blankets. Though the sun's rays were hot for an hour or two in the morning, its genial influence was never felt in the wind. The air was never very dry, the wet-bulb thermometer standing during the day 3¾° below the dry, thus giving a mean dew-point of 30¼°. A thermometer sunk two feet stood at 44°, fully 9° above the mean temperature of the air; one exposed to the clear sky, stood, during the day, several degrees below the air in shade, and at night, from 9° to 14¾° lower. The black-bulb thermometer, in the sun, rose to 65¾° above the air, indicating upwards of 90° difference at nearly the warmest part of the day, between contiguous shaded and sunny exposures. The sky, when cloudless, was generally a cold blue or steel-grey colour, but at night the stars were large, and twinkled gloriously. The black-glass photometer indicated 10·521 inches[2] as the maximum intensity of sunlight; the temperature of the river close by fell to 32° during the night, and rose to 37° in the day. In my tent, the temperature fluctuated with the state of the fire, from 26° at night to 58° when the sun beat on it; but the only choice was between cold and suffocating smoke.

After a good many conferences with the Guobah, some bullying, douce violence, persuasions, and the prescribing of pills, prayers, and charms in the shape of warm water, for the sick of the village, whereby I gained some favour, I was, on the 25th November, grudgingly prepared for the trip to Wallanchoon, with a guide, and some snow-boots for those of my party whom I took with me.

The path lay north-west up the valley, which became thickly wooded with silver-fir and juniper; we gradually ascended,

[1] This gives 1° Fahr. for every 309 feet of elevation, using contemporaneous observations at Calcutta, and correcting for latitude, &c.

[2] On three mornings the maxima occurred at between 9 and 10 A.M. They were, Nov. 24th, 10·509, Nov. 25th, 10·521. On the 25th, at Tuquoroma, I recorded 10·510. The maximum effect observed at Darjeeling (7,340 feet) was 10·328, and on the plains of India 10·350. The maximum I ever recorded was in Yangma valley (15,186 feet), 10·572 at 1 P.M.

crossing many streams from lateral gulleys, and huge masses of boulders. Evergreen rhododendrons soon replaced the firs, growing in inconceivable profusion, especially on the slopes facing the south-east, and with no otner shrubs or tree-vegetation, but scattered bushes of rose, *Spiræa*, dwarf juniper, stunted birch, willow, honey-suckle, berberry, and a mountain-ash (*Pyrus*). What surprised me more than the prevalence of rhododendron bushes, was the number of species of this genus, easily recognised by the shape of their capsules, the form and woolly covering of the leaves; none were in flower, but I reaped a rich harvest of seed. At 12,000 feet the valley was wild, open, and broad, with sloping mountains clothed for 1,000 feet with dark-green rhododendron bushes; the river ran rapidly, and was broken into falls here and there. Huge angular and detached masses of rock were scattered about, and to the right and left snowy peaks towered over the surrounding mountains, while amongst the latter narrow gulleys led up to blue patches of glacial ice, with trickling streams and shoots of stones. Dwarf rhododendrons with strongly-scented leaves (*R. anthopogon* and *setosum*), and abundance of a little *Andromeda*, exactly like ling, with woody stems and tufted branches, gave a heathery appearance to the hill-sides. The prevalence of lichens, common to this country and to Scotland (especially *L. geographicus*), which coloured the rocks, added an additional feature to the resemblance to Scotch Highland scenery. Along the narrow path I found the two commonest of all British weeds, a grass (*Poa annua*), and the shepherd's purse! They had evidently been imported by man and yaks, and as they do not occur in India, I could not but regard these little wanderers from the north with the deepest interest.

Such incidents as these give rise to trains of reflection in the mind of the naturalist traveller; and the farther he may be from home and friends, the more wild and desolate the country he is exploring, the greater the difficulties and dangers under which he encounters these subjects of his earliest studies in science; so much keener is the delight with which he recognises them, and the more lasting is the impression which they leave. At this moment these common weeds more vividly recall to me that wild scene than does all my journal, and remind me how I went on my way, taxing my memory for all it ever knew of the geographical distribution of the shepherd's purse, and musing on the probability of the plant having found its way thither over all Central Asia, and the ages that may have been occupied in its march.

On reaching 13,000 feet, the ground was everywhere hard and

frozen, and I experienced the first symptoms of lassitude, headache, and giddiness; which however, were but slight, and only came on with severe exertion.

We encountered a group of Tibetans, encamped to leeward of an immense boulder of gneiss, against which they had raised a shelter with their salt-bags, removed from their herd of yaks, which were grazing close by. They looked miserably cold and haggard, and their little upturned eyes, much inflamed and bloodshot, testified to the hardships they had endured in their march from the salt regions: they were crouched round a small fire of juniper wood, smoking iron pipes with agate mouthpieces. A resting-house was in sight across the stream—a loose stone hut, to which we repaired. I wondered why these Tibetans had not taken possession of it, not being aware of the value they attach to a rock, on account of the great warmth which it imbibes from the sun's rays during the day, and retains at night. This invaluable property of otherwise inhospitable gneiss and granite I had afterwards many opportunities of proving; and when driven for a night's shelter to such as rude nature might afford on the bleak mountain, I have had my blankets laid beneath "the shadow of a great rock in a weary land."

The name of Dhamersala is applied, in the mountains as in the plains of India, to a house provided for the accommodation of travellers, whether it be one of the beautiful caravanserais built to gratify the piety, ostentation, or benevolence of a rajah, or such a miserable shieling of rough stone and plank as that of Tuquorama, in which we took up our quarters, at 13,000 feet elevation. A cheerful fire soon blazed on the earthern floor, filling the room with the pungent odour of juniper, which made our eyes smart and water. The Ghorkas withdrew to one corner, and my Lepchas to a second, while one end was screened off for my couch; unluckily, the wall faced the north-east, and in that direction there was a gulley in the snowy mountains, down which the wind swept with violence, penetrating to my bed. I had calculated upon a good night's rest here, which I much needed, having been worried and unwell at Wallanchoon, owing to the Guobah's obstinacy. I had not then learnt how to treat such conduct, and just before retiring to rest had further been informed by the Havildar that the Guobah declared we should find no food on our return. To remain in these mountains without a supply was impossible, and the delay of sending to Mywa Guola would not have answered; so I long lay awake, occupied in arranging measures. The night was clear and very cold; the thermometer

falling to 19° at 9 P.M., and to 12° in the night, and that by my bedside to 20°.

On the following morning (Nov. 26th) I started with a small party to visit the pass, continuing up the broad, grassy valley; much snow lay on the ground at 13,500 feet, which had fallen the previous month; and several glaciers were seen in lateral ravines at about the same elevation. After a couple of miles we left the broad valley, which continued north-west, and struck northward up a narrow, stony, and steep gorge, crossing an immense ancient moraine at its mouth. This path, which we followed for seven or eight miles, led up to the pass, winding considerably, and keeping along the south-east exposures, which, being the most sunny, are the freest from snow. The morning was splendid, the atmosphere over the dry rocks and earth, at 14,000 feet, vibrating from the power of the sun's rays, whilst vast masses of blue glacier and fields of snow choked every gulley, and were spread over all shady places. Although, owing to the steepness and narrowness of the gorge, no view was obtained, the scenery was wild and very grand. Just below where perpetual snow descends to the path, an ugly carved head of a demon, with blood-stained cheeks and goggle-eyes, was placed in a niche of rock, and protected by a glass.

At 15,000 feet, the snow closed in on the path from all sides, whether perpetual, glacial, or only the October fall, I could not tell; the guide declared it to be perpetual henceforward, though now deepened by the very heavy October fall; the path was cut some three feet through it. Enormous boulders of gneiss cumbered the bottom of the gorge, which gradually widened as we approached its summit; and rugged masses of black and red gneiss and mica schist pierced the snow, and stood out in dismal relief. For four miles continuously we proceeded over snow; which was much honey-combed on the surface, and treacherous from the icy streams it covered, into which we every now and then stumbled; there was scarcely a trace of vegetation, and the cold was excessive, except in the sun.

Towards the summit of the pass the snow lay very deep, and we followed the course of a small stream which cut through it, the walls of snow being breast-high on each side; the path was still frequented by yaks, of which we overtook a small party going to Tibet, laden with planks. All the party appeared alike overcome by lassitude, shortness and difficulty of breathing, a sense of weight on the stomach, giddiness and headache, with tightness across the temples.

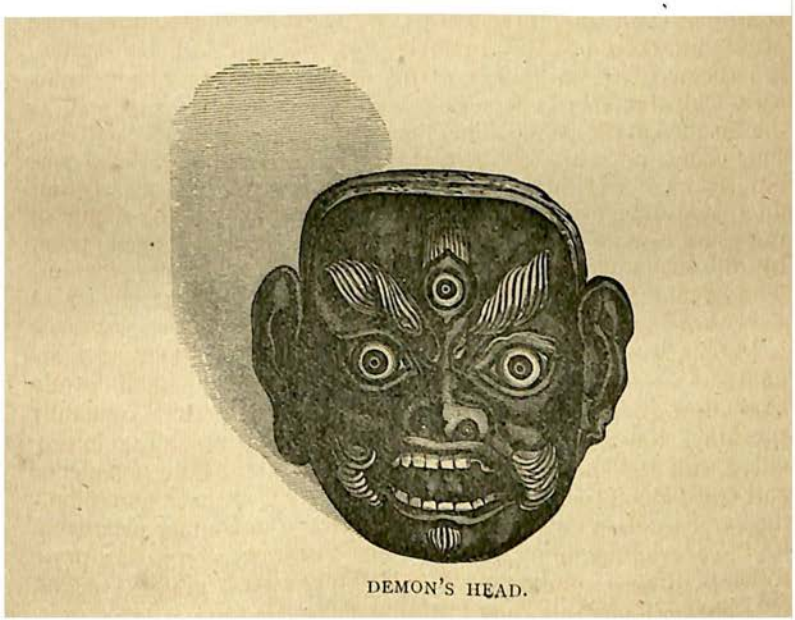
Just below the summit was a complete bay of snow, girdled with two sharp peaks of red baked schists and gneiss, strangely contorted, and thrown up at all angles with no prevalent dip or strike, and permeated with veins of granite. The top itself, or boundary between Nepal and Tibet, is a low saddle between two rugged ridges of rock, with a cairn built on it, adorned with bits of stick and rag covered with Tibetan inscriptions. The view into Tibet was not at all distant, and was entirely of snowy mountains, piled ridge over ridge; three of these spurs must, it is said, be crossed before any descent can be made to the Chomachoo river (as the Arun is called in Tibet), on which is the frontier fort of the Tibetans, and which is reached in two or three days. There is no plain or level ground of any kind before reaching that river, of which the valley is said to be wide and flat.

Starting at 10 A.M., we did not reach the top till 3½ P.M.; we had halted nowhere, but the last few miles had been most laborious, and the three of us who gained the summit were utterly knocked up. Fortunately, I carried my own barometer; it indicated 16·206 inches, giving by comparative observations with Calcutta 16,764 feet, and with Darjeeling, 16,748 feet, as the height of the pass. The thermometer stood at 18°, and the sun being now hidden behind rocks, the south-east wind was bitterly cold. Hitherto the sun had appeared as a clearly defined sparkling globe against a dark blue sky; but the depth of the azure blue was not so striking as I had been led to suppose, by the accounts of previous travellers, in very lofty regions. The plants gathered near the top of the pass were species of *Compositæ*, grass, and *Arenaria;* the most curious was *Saussurea gossypina*, which forms great clubs of the softest white wool, six inches to a foot high, its flowers and leaves seeming uniformly clothed with the warmest fur that nature can devise. Generally speaking, the alpine plants of the Himalaya are quite unprovided with any special protection of this kind; it is the prevalence and conspicuous nature of the exceptions that mislead, and induce the careless observer to generalise hastily from solitary instances: for the prevailing alpine genera of the Himalaya, *Arenarias*, primroses, saxifrages, fumitories, *Ranunculi*, gentians, grasses, sedges, &c., have almost uniformly naked foliage.

We descended to the foot of the pass in about two hours, darkness overtaking us by the way; the twilight, however, being prolonged by the glare of the snow. Fearing the distance to Tuquoroma might by too great to permit of our returning thither the same night, I had had a few things brought hither during the

day, and finding they had arrived, we encamped under the shelter of some enormous boulders (at 13,500 feet), part of an ancient moraine, which extended some distance along the bed of the narrow valley. Except an excruciating headache, I felt no ill effects from my ascent; and after a supper of tea and biscuit, I slept soundly.

On the following morning the temperature was 28° at 6·30 A.M., and rose to 30° when the sun appeared over the mountains at 8·15, at which time the black bulb thermometer suddenly mounted to 112°, upwards of 80° above the temperature of the air. The sky was brilliantly clear, with a very dry, cold, north wind blowing down the snowy valley of the pass.



DEMON'S HEAD.

CHAPTER X.

Return from Wallanchoon pass—Procure a bazaar at village—Dance of Lamas—Blacking face, Tibetan custom of—Temple and convent—Leave for Kanglachem pass—Send part of party back to Darjeeling—Yangma Guola—Drunken Tibetans—Guobah of Wallanchoon—Camp at foot of Great Moraine—View from top—Geological speculations—Height of moraines—Cross dry lake-bed—Glaciers—More moraines—Terraces—Yangma temples—Jos, books and furniture—Peak of Nango—Lake—Arrive at village—Cultivation—Scenery—Potatos—State of my provisions—Pass through village—Gigantic boulders—Terraces—Wild sheep—Lake-beds—Sun's power—Piles of granite and detritus—Glaciers and moraines—Pabuk, elevation of—Moonlight scene—Return to Yangma—Temperature, &c.—Geological causes of phenomena in valley—Scenery of valley on descent.

I RETURNED to the village of Wallanchoon, after collecting all the plants I could around my camp; amongst them a common-looking dock abounded in the spots which the yaks had frequented.

The ground was covered, as with heather, with abundance of creeping dwarf juniper, *Andromeda*, and dwarf rhododendron. On arriving at the village, I refused to receive the Guobah, unless he opened a bazaar at daylight on the following morning, where my people might purchase food; and threatened to bring charges against him before his Rajah. At the same time I arranged for sending the main body of my party down the Tambur, and so back to Sikkim, whilst I should, with as few as possible, visit the Kanglachem (Tibetan) pass in the adjacent valley to the eastward, and then, crossing the Nango, Kambachen and Kanglanamo passes, reach Jongri in Sikkim, on the south flank of Kinchinjunga.

Strolling out in the afternoon I saw a dance of Lamas; they were disfigured with black paint[1] and covered with rags, feathers, and scarlet cloth, and they carried long poles with bells and banners attached; thus equipped, they marched through the village, every now and then halting, when they danced and gesticulated to the rude music of cymbals and horns, the bystanders applauding with shouts, crackers, and alms.

I walked up to the convents, which were long, ugly buildings, several stories high, built of wood, and daubed with red and grey

[1] I shall elsewhere have to refer to the Tibetan custom of daubing the face with black pigment to protect the skin from the excessive cold and dryness of these lofty regions; and to the ludicrous imposition that was passed on the credulity of MM. Huc and Gabet.

paint. The priests were nowhere to be found, and an old withered nun, whom I disturbed husking millet in a large wooden mortar, fled at my approach. The temple stood close by the convent, and had a broad low architrave: the walls sloped inwards, as did the lintels: the doors were black, and almost covered with a gigantic and disproportioned painting of a head, with bloody cheeks and huge teeth; it was surrounded by myriads of goggle eyes, which seemed to follow one about everywhere; and though in every respect rude, the effect was somewhat imposing. The similarly proportioned gloomy portals of Egyptian fanes naturally invite comparison; but the Tibetan temples lack the sublimity of these; and the uncomfortable creeping sensation produced by the many sleepless eyes of Boodh's numerous incarnations is very different from the awe with which we contemplate the outspread wings of the Egyptian symbol, and feel as in the presence of the God who says, "I am Osiris the Great: no man hath dared to lift my veil."

I had ascended behind the village, but returned down the "via sacra," a steep paved path flanked by mendongs or low stone dykes, into which were let rows of stone slabs, inscribed with the sacred "Om Mani Padmi om."—"Hail to him of the lotus and jewel"; an invocation of Sakkya, who is usually represented holding a lotus flower with a jewel in it.

On the following morning, a scanty supply of very dirty rice was produced, at a very high price. I had, however, so divided my party as not to require a great amount of food, intending to send most of the people back by the Tambur to Darjeeling. I kept nineteen persons in all, selecting the most willing, as it was evident the journey at this season would be one of great hardship: we took seven days' food, which was as much as they could carry. At noon, I left Wallanchoon, and mustered my party at the junction of the Tambur and Yangma, whence I dismissed the party for Darjeeling, with my collections of plants, minerals, &c., and proceeded with the chosen ones to ascend the Yangma river. The scenery was wild and very grand, our path lying through a narrow gorge, choked with pine trees, down which the river roared in a furious torrent; while the mountains on each side were crested with castellated masses of rock, and sprinkled with snow. The road was very bad, often up ladders, and along planks lashed to the faces of precipices, and overhanging the torrent, which it crossed several times by plank bridges. By dark we arrived at Yangma Guola, a collection of empty wood huts buried in the rocky forest-clad valley, and took possession of a

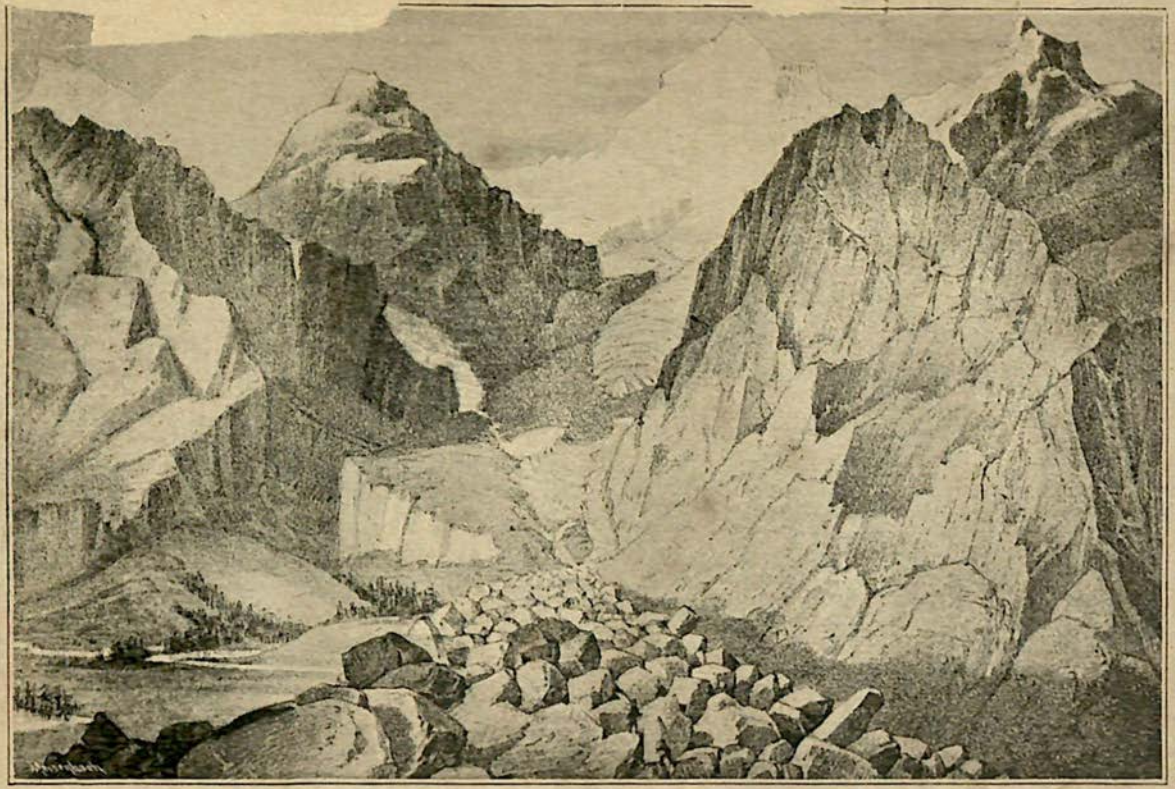
couple. They were well built, raised on posts, with a stage and ladder at the gable end, and consisted of one good-sized apartment. Around was abundance of dock, together with three common English plants.[1]

The night was calm, misty, and warm ($\frac{\text{Max. } 41^{\circ}\,5'}{\text{Min. } 29^{\circ}}$) for the elevation (9,300 feet). During the night, I was startled out of my sleep by a blaze of light, and jumping up, found myself in presence of a party of most sinister-looking, black, ragged Tibetans, armed with huge torches of pine, that filled the room with flame and pitchy smoke. I remembered their arriving just before dark, and their weapons dispelled my fears, for they came armed with bamboo jugs of Murwa beer, and were very drunk and very amiable: they grinned, nodded, kotowed, lolled out their tongues, and scratched their ears in the most seductive manner, then held out their jugs, and besought me by words and gestures to drink and be happy too. I awoke my servant (always a work of difficulty), and with some trouble ejected the visitors, happily without setting the house on fire. I heard them toppling head over heels down the stair, which I afterwards had drawn up to prevent further intrusion, and in spite of their drunken orgies, was soon lulled to sleep again by the music of the roaring river.

On the 29th November, I continued my course north up the Yangma valley, which after five miles opened considerably, the trees disappearing, and the river flowing more tranquilly, and through a broader valley, when above 11,000 feet elevation. The Guobah of Wallanchoon overtook us on the road; on his way, he said, to collect the revenues at Yangma village, but in reality to see what I was about. He owns five considerable villages, and is said to pay a tax of 6,000 rupees (£600) to the Rajah of Nepal: this is no doubt a great exaggeration, but the revenues of such a position, near a pass frequented almost throughout the year, must be considerable. Every yak going and coming is said to pay 1*s.*, and every horse 4*s.*; cattle, sheep, ponies, land, and wool are all taxed; he exports also quantities of timber to Tibet, and various articles from the plains of India. He joined my party and halted where I did, had his little Chinese rug spread, and squatted cross-legged on it, whilst his servant prepared his brick tea with salt, butter, and soda, of which he partook, snuffed, smoked, rose up, had all his traps repacked, and was off again.

We encamped at a most remarkable place: the valley was

[1] *Cardamine hirsuta*, *Limosella aquatica*, and *Juncus bufonius*



ANCIENT MORAINE THROWN ACROSS THE YANGMA VALLEY, EAST NEPAL. ELEVATION, 11,000 FT.

broad, with little vegetation but stunted tree-junipers: rocky snow-topped mountains rose on either side, bleak, bare, and rugged, and in front, close above my tent, was a gigantic wall of rocks, piled—as if by the Titans—completely across the valley, for about three-quarters of a mile. This striking phenomenon had excited all my curiosity on first obtaining a view of it. The path, I found, led over it, close under its west end, and wound amongst the enormous detached fragments of which it was formed, and which were often eighty feet square: all were of gneiss and schist, with abundance of granite in blocks and veins. A superb view opened from the top, revealing its nature to be a vast moraine, far below the influence of any existing glaciers, but which at some antecedent period had been thrown across by a glacier descending to 10,000 feet, from a lateral valley on the east flank. Standing on the top, and looking south, was the Yangma valley (up which I had come), gradually contracting to a defile, girdled by snow-tipped mountains, whose rocky flanks mingled with the black pine forest below. Eastward the moraine stretched south of the lateral valley, above which towered the snowy peak of Nango, tinged rosy red, and sparkling in the rays of the setting sun: blue glaciers peeped from every gulley on its side, but these were 2,000 to 3,000 feet above this moraine; they were small too, and their moraines were mere gravel, compared with this. Many smaller consecutive moraines, also, were evident along the bottom of that lateral valley, from this great one up to the existing glaciers. Looking up the Yangma was a flat grassy plain, hemmed in by mountains, and covered with other stupendous moraines, which rose ridge behind ridge, and cut off the view of all but the mountain tops to the north. The river meandered through the grassy plain (which appeared a mile and a half broad at the utmost, and perhaps as long), and cut through the great moraine on its eastern side, just below the junction of the stream from the glacial valley, which, at the lower part of its course, flowed over a broad steep gravel bed.

I descended to my camp, full of anxious anticipations for the morrow; while the novelty of the scene, and its striking character, the complexity of the phenomena, the lake-bed, the stupendous ice-deposited moraine, and its remoteness from any existing ice, the broad valley and open character of the country, were all marked out as so many problems suddenly conjured up for my unaided solution, and kept me awake for many hours. I had never seen a glacier or moraine on land before, but being familiar with sea ice and berg transport, from voyaging in the South

Polar regions, I was strongly inclined to attribute the formation of this moraine to a period when a glacial ocean stood high on the Himalaya, made fiords of the valleys, and floated bergs laden with blocks from the lateral gulleys, which the winds and currents would deposit along certain lines. On the following morning I carried a barometer to the top of the moraine, which proved to be upwards of 700 feet above the floor of the valley, and 400 above the dry lake-bed which it bounded, and to which we descended on our route up the valley. The latter was grassy and pebbly, perfectly level, and quite barren, except a very few pines at the bases of the encircling mountains, and abundance of rhododendrons, *Andromeda* and juniper on the moraines. Isolated moraines occurred along both flanks of the valley, some higher than that I have described, and a very long one was thrown nearly across from the upper end of another lateral gulley on the east side, also leading up to the glaciers of Nango. This second moraine commenced a mile and a half above the first, and abutting on the east flank of the valley, stretched nearly across, and then swerving round, ran down it, parallel to and near the west flank, from which it was separated by the Yangma river: it was abruptly terminated by a conical hill of boulders, round whose base the river flowed, entering the dry lake-bed from the west, and crossing it in a south-easterly direction to the western extremity of the great moraine.

The road, on its ascent to the second moraine, passed over an immense accumulation of glacial detritus at the mouth of the second lateral valley, entirely formed of angular fragments of gneiss and granite, loosely bound together by felspathic sand. The whole was disposed in concentric ridges radiating from the mouth of the valley, and descending to the flat; these were moraines *in petto*, formed by the action of winter snow and ice upon the loose débris. A stream flowed over this débris, dividing into many branches before reaching the lake-bed, where its waters were collected, and whence it meandered southward to fall into the Yangma.

From the top of the second moraine, a very curious scene opened up the valley, of another but more stony and desolate level lake-bed, through which the Yangma (here very rapid) rushed, cutting a channel about sixty feet deep; the flanks of this second lake-bed were cut most distinctly into two principal terraces, which were again subdivided into others, so that the general appearance was that of many raised beaches, but each so broken up, that, with the exception of one on the banks of the

river, none were continuous for any distance. We descended 200 feet, and crossed the valley and river obliquely in a north-west direction, to a small temple and convent which stood on a broad flat terrace under the black, precipitous, west flank; this gave me a good opportunity of examining the structure of this part of the valley, which was filled with an accumulation, probably 200 feet thick at the deepest part, of angular gravel and enormous boulders, both imbedded in the gravel, and strewed on the flat surfaces of the terraces. The latter were always broadest opposite to the lateral valleys, perfectly horizontal for the short distance that they were continuous, and very barren; there were no traces of fossils, nor could I assure myself of stratification. The accumulation was wholly glacial; and probably a lake had supervened on the melting of the great glacier and its recedence, which lake, confined by a frozen moraine, would periodically lose its waters by sudden accessions of heat melting the ice of the latter. Stratified silt, no doubt, once covered the lake bottom, and the terraces have, in succession, been denuded of it by rain and snow. These causes are now in operation amongst the stupendous glaciers of north-east Sikkim, where valleys, dammed up by moraines, exhibit lakes hemmed in between these, the base of the glacier, and the flanks of the valleys.

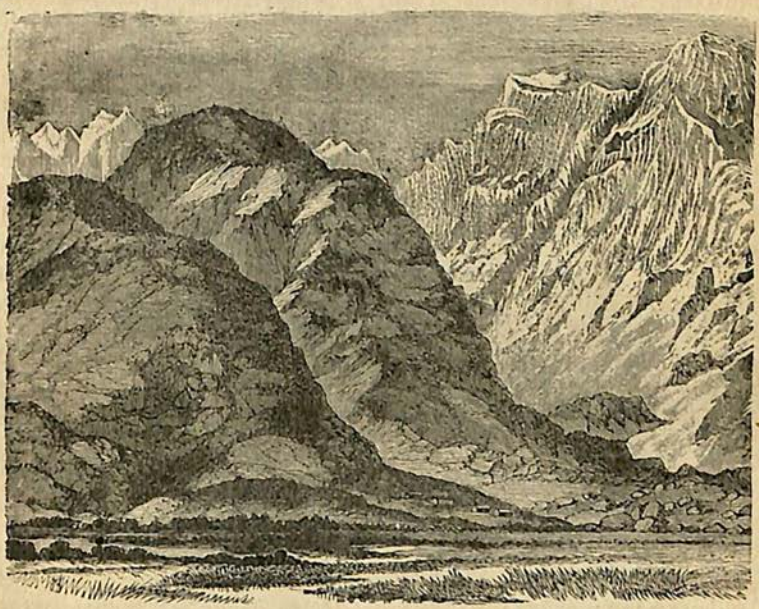
ANCIENT MORAINES IN THE YANGMA VALLEY.

Yangma convents stood at the mouth of a gorge which opened upon the uppermost terrace; and the surface of the latter, here well covered with grass, was furrowed into concentric radiating ridges, which were very conspicuous from a distance. The buildings consisted of a wretched collection of stone huts,

painted red, enclosed by loose stone dykes. Two shockingly dirty Lamas received me and conducted me to the temple, which had very thick walls, but was undistinguishable from the other buildings. A small door opened upon an apartment piled full of old battered gongs, drums, scraps of silk hangings, red cloth, broken praying-machines—relics much resembling those in the lumber-room of a theatre. A ladder led from this dismal hole to the upper story, which was entered by a handsomely carved and gilded door: within, all was dark, except from a little lattice-window covered with oil-paper. On one side was the library, a carved case, with a hundred gilded pigeon-holes, each holding a real or sham book, and each closed by a little square door, on which hung a bag full of amulets. In the centre of the book-case was a recess, containing a genuine Jos or Fo, graced with his Chinese attribute of very long pendulous moustaches and beard, and totally wanting that air of contemplative repose which the Tibetan Lamas give to their idols. Banners were suspended around, with paintings of Lhassa, Teshoo Loombo, and various incarnations of Boodh. The books were of the usual Tibetan form, oblong squares of separate block-printed leaves of paper, made in Nepal or Bhotan from the bark of a *Daphne*, bound together by silk cords, and placed between ornamented wooden boards. On our way up the valley, we had passed some mendongs and chaits, the latter very pretty stone structures, consisting of a cube, pyramid, hemisphere, and cone placed on the top of one another, forming together a tasteful combination.

Beyond the convents the valley again contracted, and on crossing a third, but much lower, moraine, a lake opened to view, surrounded by flat terraces, and a broad gravelly shore, part of the lake being dry. To the west, the cliffs were high, black and steep; to the east a large lateral valley, filled at about 1,500 feet up with blue glaciers, led (as did the other lateral valleys) to the gleaming snows of Nango'; the moraine, too, here abutted on the east flank of the Yangma valley, below the mouth of the lateral one. Much snow (from the October fall) lay on the ground, and the cold was pinching in the shade; still I could not help attempting to sketch this wonderfully grand scene, especially as lakes in the Himalaya are extremely rare: the present one was about a mile long, very shallow, but broad, and as smooth as glass: it reminded me of the tarn in Glencoe. The reflected lofty peak of Nango appeared as if frozen deep down in its glassy bed, every snowy crest and ridge being rendered with perfect precision.

Nango is about 18,000 feet high; it is the next lofty mountain of the Kinchinjunga group to the west of Junnoo, and I doubt if any equally high peak occurs again for some distance further west in Nepal. Facing the Yangma valley, it presents a beautiful range of precipices of black rock, capped with a thick crust of snow; below the cliffs the snow again appears continuously and very steep, for 2,000 to 3,000 feet downwards, where it terminates in glaciers that descend to 14,000 feet. The steepest snow-beds appear cut into vertical ridges, whence the whole snowy face is—as it were—crimped in perpendicular, closely-set, zigzag lines,



LOOKING ACROSS YANGMA VALLEY.

doubtless caused by the melting process, which furrows the surface of the snow into channels by which the water is carried off; the effect is very beautiful, but impossible to represent on paper, from the extreme delicacy of the shadows, and at the same time the perfect definition and precision of the outlines.

Towards the head of the lake, its bed was quite dry and gravelly, and the river formed a broad delta over it; the terraces here were perhaps 100 feet above its level, those at the lower end not nearly so much. Beyond the lake the river became again a

violent torrent, rushing in a deep chasm, till we arrived at the fork of the valley, where we once more met with numerous dry lake-beds, with terraces high up on the mountain sides.

In the afternoon we reached the village of Yangma, a miserable collection of 200 to 300 stone huts, nestling under the steep south-east flank of a lofty, flat-topped terrace, laden with gigantic glacial boulders, and projecting southward from a snowy mountain which divides the valley. We encamped on the flat under the village, amongst some stone dykes, enclosing cultivated fields. One arm of the valley runs hence N.N.E. amongst snowy mountains, and appeared quite full of moraines; the other, or continuation of the Yangma, runs W.N.W., and leads to the Kanglachem pass.

Near our camp (of which the elevation was 13,500 feet), radishes, barley, wheat, potatos, and turnips, were cultivated as summer crops, and we even saw some on the top of the terrace, 400 feet above our camp, or nearly 14,000 feet above the sea; these were grown in small fields cleared of stones, and protected by dykes.

The scenery, though dismal (no juniper even attaining this elevation), was full of interest and grandeur, from the number and variety of snowy peaks and glaciers all around, the elevated horizon, the ancient lake-beds, now green or brown with scanty vegetation, the vast moraines, the ridges of glacial débris, the flat terraces, marking, as it were with parallel roads, the bluff sides of the mountains, the enormous boulders perched upon them, and strewed everywhere around, the little Boodhist monuments of quaint, picturesque shapes, decorated with poles and banners, the many-coloured dresses of the people, the brilliant blue of the cloudless heaven by day, the depth of its blackness by night, heightened by the light of the stars, that blaze and twinkle with a lustre unknown in less lofty regions: all these were subjects for contemplation, rendered more impressive by the stillness of the atmosphere, and the silence that reigned around. The village seemed buried in repose throughout the day: the inhabitants had already hybernated, their crops were stored, the curd made and dried, the passes closed, the soil frozen, the winter's stock of fuel housed, and the people had retired into the caverns of their half subterranean houses, to sleep, spin wool, and think of Boodh, if of anything at all, the dead, long winter through. The yaks alone can find anything to do; so long as any vegetation remains they roam and eat it, still yielding milk, which the women take morning and evening, when their shrill whistle and cries are heard

for a few minutes, as they call the grunting animals. No other sounds, save the harsh roar and hollow echo of the falling rock, glacier, or snow-bed, disturbed the perfect silence of the day or night.[1]

I had taken three days' food to Yangma, and stayed there as long as it lasted; the rest of my provisions I had left below the first moraine, where a lateral valley leads east over the Nango pass to the Kambachen valley, which lay on the route back to Sikkim.

I was premature in complaining of my Wallanchoon tents, those provided for me at Yangma being infinitely worse, mere rags, around which I piled sods as a defence from the insidious piercing night-wind that descended from the northern glaciers in calm, but most keen, breezes. There was no food to be procured in the village, except a little watery milk, and a few small watery potatos. The latter have only very recently been introduced amongst the Tibetans, from the English garden at the Nepalese capital, I believe, and their culture has not spread in these regions further east than Kinchinjunga, but they will very soon penetrate into Tibet, from Darjeeling, or eastward from Nepal. My private stock of provisions—consisting chiefly of preserved meats from my kind friend Mr. Hodgson—had fallen very low; and I here found to my dismay that of four remaining two-pound cases, provided as meat, three contained prunes, and one "*dindon aux truffes!*" Never did luxuries come more inopportunely; however, the greasy French viand served for many a future meal as sauce to help me to bolt my rice, and according to the theory of chemists, to supply animal heat in these frigid regions. As for my people, they were not accustomed to much animal food; two pounds of rice, with ghee and chilis, forming their common diet under cold and fatigue. The poorer Tibetans, especially, who undergo great privation and toil, live almost wholly on barley-meal, with tea, and a very little butter and salt; this is not only the case with those amongst whom I mixed so much, but is also mentioned by MM. Huc and Gabet, as having been observed by them in other parts of Tibet.

On the 1st of December I visited the village and terrace, and proceeded to the head of the Yangma valley, in order to ascend the Kanglachem pass as far as practicable. The houses are low, built of stone, of no particular shape, and are clustered in groups against the steep face of the terrace; filthy lanes wind amongst

[1] Snow covers the ground at Yangma from December till April, and the falls are said to be very heavy, at times amounting to 12 feet in depth.

them, so narrow, that if you are not too tall, you look into the slits of windows on either hand, by turning your head, and feel the noisome warm air in whiffs against your face. Glacial boulders lie scattered throughout the village, around and beneath the cluster of houses, from which it is sometimes difficult to distinguish the native rock. I entered one house by a narrow low door through walls four feet thick, and found myself in an apartment full of wool, juniper-wood, and dried dung for fuel: no one lived in the lower story, which was quite dark, and as I stood in it my head was in the upper, to which I ascended by a notched pole (like that in the picture of a Kamschatk house in Cook's voyage), and went into a small low room. The inmates looked half asleep, they were intolerably indolent and filthy, and were employed in spinning wool and smoking. A hole in the wall of the upper apartment led me on to the stone roof of the neighbouring house, from which I passed to the top of a glacial boulder, descending thence by rude steps to the narrow alley. Wishing to see as much as I could, I was led on a winding course through, in and out, and over the tops of the houses of the village, which alternately reminded me of a stone quarry or gravel pit, and gypsies living in old lime-kilns; and of all sorts of odd places that are turned to account as human habitations.

From the village I ascended to the top of the terrace, which is perfectly level, sandy, triangular plain, pointing down the valley at the fork of the latter, and abutting against the flank of a steep, rocky, snow-topped mountain to the northward. Its length is probably half a mile from north to south, but it runs for two miles westward up the valley, gradually contracting. The surface, though level, is very uneven, being worn into hollows, and presenting ridges and hillocks of blown sand and gravel, with small black tufts of rhododendron. Enormous boulders of gneiss and granite were scattered over the surface: one of the ordinary size, which I measured, was seventy feet in girth, and fifteen feet above the ground, into which it had partly sunk. From the southern pointed end I took sketches of the opposite flanks of the valleys east and west. The river was about 400 feet below me, and flowed in a little flat lake-bed; other terraces skirted it, cut out, as it were, from the side of that I was on. On the opposite flank of the valley were several superimposed terraces, of which the highest appeared to tally with the level we occupied, and the lowest was raised very little above the river; none were continuous for any distance, but the upper one in particular, could be most conspicuously traced up and down the main

valley, whilst, on looking across to the eastern valley, a much higher, but less distinctly marked one appeared on it. The road to the pass lay west-north-west up the north bank of the Yangma river, on the great terrace; for two miles it was nearly level along the gradually narrowing shelf, at times dipping into the steep gulleys formed by lateral torrents from the mountains; and as the terrace disappeared, or melted, as it were, into the rising floor of the valley, the path descended upon the lower and smaller shelf.

DIAGRAM OF THE GLACIAL TERRACES AT THE FORK OF THE YANGMA VALLEY.

We came suddenly upon a flock of gigantic wild sheep, feeding on scanty tufts of dried sedge and grass; there were twenty-five of these enormous animals, of whose dimensions the term sheep gives no idea: they are very long-legged, stand as high as a calf, and have immense horns, so large that a fox is said to take up his abode in their hollows, when detached and bleaching, on the barren mountains of Tibet. Though very wild, I am sure I could easily have killed a couple had I had my gun, but I had found it necessary to reduce my party so uncompromisingly, that I could not afford a man both for my gun and instruments, and had sent the former back to Darjeeling, with

Mr. Hodgson's bird-stuffers, who had broken one of theirs. Travelling without firearms sounds strange in India, but in these regions animal life is very rare, game is only procured with much hunting and trouble, and to come within shot of a flock of wild sheep was a contingency I never contemplated. Considering how very short we were of any food, and quite out of animal diet, I could not but bitterly regret the want of a gun, but consoled myself by reflecting that the instruments were still more urgently required to enable me to survey this extremely interesting valley. As it was, the great beasts trotted off, and turned to tantalise me by grazing within an easy stalking distance. We saw several other flocks, of thirty to forty, during the day, but never, either on this or any future occasion, within shot. The *Ovis Ammon* of Pallas stands four to five feet high, and measures seven feet from nose to tail; it is quite a Tibetan animal, and is seldom seen below 14,000 feet, except when driven lower by snow; and I have seen it as high as 18,000 feet. The same animal, I believe, is found in Siberia, and is allied to the Big-horn of North America.

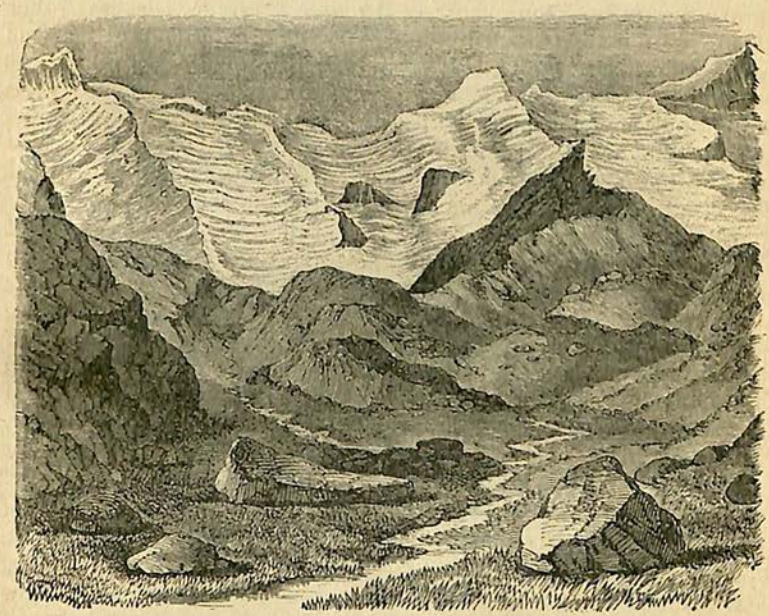
Soon after descending to the bed of the valley, which is broad and open, we came on a second dry lake-bed, a mile long, with shelving banks all round, heavily snowed on the shaded side; the river was divided into many arms, and meandered over it, and a fine glacier-bound valley opened into it from the south. There were no boulders on its surface, which was pebbly, with tufts of grass and creeping tamarisk. On the banks I observed much granite, with large mica crystals, hornstone, tourmaline, and stratified quartz, with granite veins parallel to the foliation or lamination.

A rather steep ascent of a mile, through a contracted part of the valley, led to another and smaller lake-bed, a quarter of a mile long and 100 yards broad, covered with patches of snow, and having no lateral valley opening into it: it faced the now stupendous masses of snow and ice which filled the upper part of the Yangma valley. This lake-bed (elevation, 15,186 feet) was strewed with enormous boulders; a rude stone hut stood near it, where we halted for a few minutes at 1 P.M., when the temperature was 42·2°, while the dew-point was only 20·7°.[1] At the same time the black bulb thermometer, fully exposed to the snow, rose 54° above the air, and the photometer gave 10·572. Though the sun's power was so great, there was, however, no appearance

[1] This indicates a very dry state of the air, the saturation-point being 0·133°; whereas, at the same hour at Calcutta it was 0·559°.

of the snow melting, evaporation proceeding with too great rapidity.

Enormous piles of gravel and sand had descended upon the upper end of this lake-bed, forming shelves, terraces, and curving ridges, apparently consolidated by ice, and covered in many places with snow. Following the stream, we soon came to an immense moraine, which blocked up the valley, formed of angular boulders, some of which were fifty feet high. Respiration had been difficult for some time, and the guide we had taken from the village said we were some hours from the top of the pass, and



KANGLACHEM PASS.

could get but a little way further; we however proceeded, plunging through the snow, till on cresting the moraine a stupendous scene presented itself. A gulf of moraines, and enormous ridges of débris, lay at our feet, girdled by an amphitheatre of towering, snow-clad peaks, rising to 17,000 and 18,000 feet all around. Black scarped precipices rose on every side; deep snow-beds and blue glaciers rolled down every gully, converging in the hollow below, and from each transporting its own materials, there ensued a complication of moraines, that presented no order to the

eye. In spite of their mutual interference, however, each had raised a ridge of débris or moraine parallel to itself.

We descended with great difficulty through the soft snow that covered the moraine, to the bed of this gulf of snow and glaciers; and halted by an enormous stone, above the bed of a little lake, which was snowed all over, but surrounded by two superimposed level terraces, with sharply defined edges. The moraine formed a barrier to its now frozen waters, and it appeared to receive the drainage of many glaciers, which filtered through their gravelly ridges and moraines.

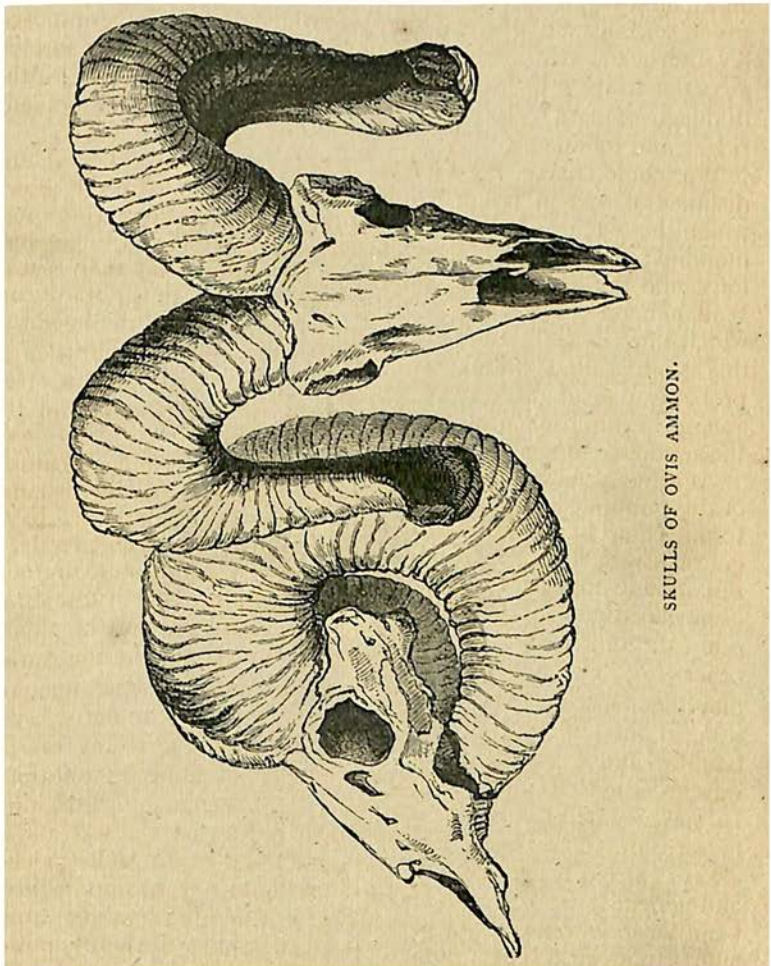
We could make no further progress; the pass lay at the distance of several hours' march, up a valley to the north, down which the glacier must have rolled that had deposited this great moraine; the pass had been closed since October, it being very lofty, and the head of this valley was far more snowy than that at Wallanchoon. We halted in the snow from 3 to 4 P.M., during which time I again took angles and observations; the height of this spot, called Pabuk, is 16,038 feet, whence the pass is probably considerably over 17,000 feet, for there was a steep ascent beyond our position. The sun sank at 3 P.M., and the thermometer immediately fell from 35° to 30¾.[1]

After fixing in my note and sketch books the principal features of this sublime scene, we returned down the valley: the distance to our camp being fully eight miles, night overtook us before we got half-way, but a two days' old moon guided us perfectly, a remarkable instance of the clearness of the atmosphere at these great elevations. Lassitude, giddiness, and headache came on as our exertions increased, and took away the pleasure I should otherwise have felt in contemplating by moonlight the varied phenomena, which seemed to crowd upon the restless imagination, in the different forms of mountain, glacier, moraine, lake, boulder and terrace. Happily I had noted everything on my way up, and left nothing intentionally to be done on returning. In making such excursions as this, it is above all things desirable to seize and book every object worth noting on the way out: I always carried my note-book and pencil tied to my jacket-pocket, and generally walked with them in my hand. It is impossible to begin observing too soon, or to observe too much: if the excursion is long, little is ever done on the way home: the bodily powers being mechanically exerted, the mind seeks repose, and being

[1] At 4 o'clock, to 29°·5, the average dew-point was 16°·3, and dryness 0·55; weight of vapour in a cubic foot, 1·33 grains.

fevered through over-exertion, it can endure no train of thought, or be brought to bear on a subject.

During my stay at Yangma, the thermometer never rose to 50°, it fell to 14¾° at night; the ground was frozen for several inches



SKULLS OF OVIS AMMON.

below the surface, but at two feet depth its temperature was 37½°. The black bulb thermometer rose on one occasion 84° above the surrounding air. Before leaving, I measured by angles and a base-line the elevations of the great village terrace above the

river, and that of a loftier one, on the west flank of the main valley; the former was about 400 and the latter 700 feet.

Considering this latter as the upper terrace, and concluding that it marks a water level, it is not very difficult to account for its origin. There is every reason to suppose that the flanks of the valley were once covered to the elevation of the upper terrace, with an enormous accumulation of débris; though it does not follow that the whole valley was filled by ice-action to the same depth; the effect of glaciers being to deposit moraines between themselves and the sides of the valley they fill; as also to push forward similar accumulations. Glaciers from each valley, meeting at the fork, where their depth would be 700 feet of ice, would both deposit the necessary accumulation along the flanks of the great valley, and also throw a barrier across it. The melting waters of such glaciers would accumulate in lakes, confined by the frozen earth, between the moraines and mountains. Such lakes, though on a small scale, are found at the terminations and sides of existing glaciers, and are surrounded by terraces of shingle and débris; these terraces being laid bare by the sudden drainage of the lakes during seasons of unusual warmth. To explain the phenomena of the Yangma valley, it may be necessary to demand larger lakes and deeper accumulations of débris than are now familiar to us, but the proofs of glaciers having once descended to from 8,000 to 10,000 feet in every Sikkim and east Nepal valley communicating with mountains above 16,000 feet elevation, are overwhelming, and the glaciers must, in some cases, have been fully forty miles long, and 500 feet in depth. The absence of any remains of a moraine, or of blocks of rock in the valley below the fork, is, I believe, the only apparent objection to this theory; but, as I shall elsewhere have occasion to observe, the magnitude of a moraine bears no fixed proportion to that of the glacier which formed it, and at Pabuk, the steep ridges of débris, which were heaped up 200 feet high, were far more striking than the more usual form of moraine.

On my way up to Yangma I had rudely plotted the valley, and selected prominent positions for improving my plan on my return: these I now made use of, taking bearings with the azimuth compass, and angles by means of a pocket sextant. The result of my running-survey of the whole valley, from 10,000 to 16,000 feet, I have given along with a sketch-map of my routes in India, which accompanies this volume.

CHAPTER XI.

Ascend to Nango mountain—Moraines—Glaciers—Vegetation—*Rhododendron Hodgsoni*—Rocks—Honeycombed surface of snow—Perpetual snow—Top of pass—View—Elevation—Geology—Distance of sound—Plants—Temperature—Scenery—Cliffs of granite and hurled boulders—Camp—Descent—Pheasants—Larch—Himalayan pines—Distribution of Deodar, note on—Tassichooding temples—Kambachen village—Cultivation—Moraines in valley, distribution of—Picturesque lake-beds, and their vegetation—Tibetan sheep and goats—*Cryptogramma crispa*—Ascent to Choonjerma pass—View of Junnoo—Rocks of its summit—Misty ocean—Nepal peaks—Top of pass—Temperature, and observations—Gorgeous sunset—Descent to Yalloong valley—Loose path—Night scenes—Musk deer.

We passed the night a few miles below the great moraine, in a pine-wood (alt. 11,000 feet) opposite the gorge which leads to the Kambachen or Nango pass, over the south shoulder of the mountain of that name: it is situated on a ridge dividing the Yangma river from that of Kambachen, which latter falls into the Tambur opposite Lelyp.

The road crosses the Yangma (which is about fifteen feet wide), and immediately ascends steeply to the south-east, over a rocky moraine, clothed with a dense thicket of rhododendrons, mountain-ash, maples, pine, birch, juniper, &c. The ground was covered with silvery flakes of birch bark, and that of *Rhododendron Hodgsoni*, which is as delicate as tissue-paper, and of a pale flesh-colour. I had never before met with this species, and was astonished at the beauty of its foliage, which was of a beautiful bright green, with leaves sixteen inches long.

Beyond the region of trees and large shrubs the alpine rhododendrons filled the broken surface of the valley, growing with *Potentilla*, Honeysuckle, *Polygonum*, and dwarf juniper. The peak of Nango seemed to tower over the gorge, rising behind some black, splintered, rocky cliffs, sprinkled with snow; narrow defiles opened up through these cliffs to blue glaciers, and their mouths were invariably closed by beds of gravelly moraines, curving outwards from either flank in concentric ridges.

Towards the base of the peak, at about 14,000 feet, the scenery is very grand; a great moraine rises suddenly to the north-west, under the principal mass of snow and ice, and barren slopes of gravel descend from it; on either side are rugged precipices; the ground is bare and stony, with patches of brown grass: and, on looking back, the valley appears very steep to the first shrubby vegetation, of dark green rhododendrons, bristling with ugly stunted pines.

We followed a valley to the south-east, so as to turn the flank of the peak; the path lying over beds of October snow at 14,000 feet, and over plashy ground, from its melting. Sometimes our way lay close to the black precipices on our right, under which the snow was deep; and we dragged ourselves along, grasping every prominence of the rock with our numbed fingers. Granite appeared in large veins in the crumpled gneiss at a great elevation, in its most beautiful and loosely-crystallised form, of pearly white prisms of felspar, glassy quartz, and milk-white flat plates of mica, with occasionally large crystals of tourmaline. Garnets were very frequent in the gneiss near the granite veins. Small rushes, grasses, and sedges formed the remaining vegetation, amongst which were the withered stalks of gentians, *Sedum*, *Arenaria*, *Silene*, and many Composite plants.

At a little below 15,000 feet, we reached enormous flat beds of snow, which were said to be perpetual, but covered deeply with the October fall. They were continuous, and like all the snow I saw at this season, the surface was honeycombed into thin plates, dipping north at a high angle; the intervening fissures were about six inches deep. A thick mist here overtook us, and this, with the great difficulty of picking our way, rendered the ascent very fatiguing. Being sanguine about obtaining a good view, I found it almost impossible to keep my temper under the aggravations of pain in the forehead, lassitude, oppression of breathing, a dense drizzling fog, a keen cold wind, a slippery footing, where I was stumbling at every few steps, and icy-cold wet feet, hands, and eyelids; the latter, odd as it sounds, I found a very disagreeable accompaniment of continued raw cold wind.

After an hour and a half's toilsome ascent, during which we made but little progress, we reached the crest, crossing a broad shelf of snow between two rocky eminences; the ridge was unsnowed a little way down the east flank; this was, in a great measure, due to the eastern exposure being the more sunny, to the prevalence of warm and melting south-east winds that blow up the deep Kambachen valley, and to the fact that the great snow-beds on the west side are drifted accumulations.[1] The mist

[1] Such enormous beds of snow in depressions, or on gentle slopes, are generally adopted as indicating the lower limit of perpetual snow. They are, however, winter accumulations, due mainly to eddies of wind, of far more snow than can be melted in the following summer, being hence perennial in the ordinary sense of the word. They pass into the state of glacier ice, and, obeying the laws that govern the motions of a viscous fluid, so admirably elucidated by Forbes ("Travels in the Alps"), they flow downwards. A careful examination of those great beds of snow in the Alps, from whose

cleared off, and I had a partial, though limited, view. To the north the blue ice-clad peak of Nango was still 2,000 feet above us, its snowy mantle falling in great sweeps and curves into glacier-bound valleys, over which the ice streamed out of sight, bounded by black aiguilles of gneiss. The Yangma valley was quite hidden, but to the eastward the view across the stupendous gorge of the Kambachen, 5,000 feet below, to the waste of snow, ice, and rock, piled in confusion along the top of the rangè of Junnoo and Choonjerma, parallel to this but higher, was very grand indeed: this we were to cross in two days, and its appearance was such, that our guide doubted the possibility of our doing it. A third and fourth mountain mass (unseen) lay beyond this, between us and Sikkim, divided by valleys as deep as those of Yangma and Kambachen.

Having hung up my instruments, I ascended a few hundred feet to some naked rocks, to the northward; they were of much-crumpled and dislocated gneiss, thrown up at a very high angle, and striking north-west. Chlorite, schist, and quartz, in thin beds, alternated with the gneiss, and veins of granite and quartz were injected through them.

It fell calm; when the distance to which the voice was carried was very remarkable; I could distinctly hear every word spoken 300 to 400 yards off, and did not raise my voice when I asked one of the men to bring me a hammer.

The few plants about were generally small tufted *Arenarias* and woolly *Compositæ*, with a thick-rooted Umbellifer that spread its short, fleshy leaves and branches flat on the ground; the root was very aromatic, but wedged close in the rock. The temperature at 4 P.M. was 23°, and bitterly cold; the elevation, 15,770 feet; dew-point, 16°. The air was not very dry; saturation-point, 0·670°, whereas at Calcutta it was 0·498° at the same hour.

The descent was to a broad, open valley, into which the flank of Nango dipped in tremendous precipices, which reared their heads in splintered snowy peaks. At their bases were shoots of débris fully 700 feet high, sloping at a steep angle. Enormous masses of rock, detached by the action of the frost and ice from the crags, were scattered over the bottom of the valley; they had been precipitated from above, and gaining impetus in their

position the mean lower level of perpetual snow, in that latitude, is deduced, has convinced me that these are mainly due to accumulations of this kind, and that the true limit of perpetual snow, or that point where all that falls melts, is much higher than it is usually supposed to be.

descent, had been hurled to almost inconceivable distances from the parent cliff. All were of a very white, fine-grained crystallised granite, full of small veins of the same rock still more finely crystallised. The weathered surface of each block was black, and covered with moss and lichens; the others beautifully white, with clean, sharp-fractured edges. The material of which they were composed was so hard that I found it difficult to detach a specimen.

Darkness had already come on, and the coolies being far behind, we encamped by the light of the moon, shining through a thin fog, where we first found dwarf-juniper for fuel, at 13,500 feet. A little sleet fell during the night, which was tolerably fine, and not very cold; the minimum thermometer indicating $14\frac{1}{2}^{\circ}$.

Having no tent-poles, I had some difficulty in getting my blankets arranged as a shelter, which was done by making them slant from the side of a boulder, on the top of which one end was kept by heavy stones; under this roof I laid my bed, on a mass of rhododendron and juniper-twigs. The men did the same against other boulders, and lighting a huge fire opposite the mouth of my ground-nest, I sat cross-legged on the bed to eat my supper; my face scorching, and my back freezing. Rice, boiled with a few ounces of greasy *dindon aux truffes* was now my daily dinner, with chili-vinegar and tea, and I used to relish it keenly: this finished, I smoked a cigar, and wrote up my journal (in short intervals between warming myself) by the light of the fire; took observations by means of a dark-lantern; and when all this was accomplished, I went to roost.

December 5.—On looking out this morning, it was with a feeling of awe that I gazed at the stupendous ice-crowned precipices that shot up to the summit of Nango, their flanks spotted white at the places whence the gigantic masses with which I was surrounded had fallen; thence my eye wandered down their black faces to the slope of débris at the bottom, thus tracing the course which had probably been taken by that rock under whose shelter I had passed the previous night.

Meepo, the Lepcha sent by the rajah, had snared a couple of beautiful pheasants, one of which I skinned, and ate for breakfast; it is a small bird, common above 12,000 feet, but very wild; the male has two to five spurs on each of its legs, according to its age; the general colour is greenish, with a broad scarlet patch surrounding the eye; the Nepalese name is "Khalidge." The crop was distended with juniper berries, of which the flesh tasted

strongly, and it was the very hardest, toughest bird I ever did eat.

We descended at first through rhododendron and juniper, then through black silver-fir (*Abies Webbiana*), and below that, near the river, we came to the Himalayan larch; a tree quite unknown, except from a notice in the journals of Mr. Griffith, who found it in Bhotan. It is a small tree, twenty to forty feet high, perfectly similar in general characters to a European larch, but with larger cones, which are erect upon the very long, pesile, whip-like branches; its leaves—now red—were falling, and covering the rocky ground on which it grew, scattered amongst other trees. It is called "Saar" by the Lepchas and Cis-himalayan Tibetans, and "Boarga-sella" by the Nepalese, who say it is found as far west as the heads of the Cosi river: it does not inhabit Central or West Nepal, nor the North-west Himalaya. The distribution of the Himalayan pines is very remarkable. The Deodar has not been seen east of Nepal, nor the *Pinus Gerardiana*, *Cupressus torulosa*, or *Juniperus communis*. On the other hand, *Podocarpus* is confined to the east of Katmandoo. *Abies Brunoniana* does not occur west of the Gogra, nor the larch west of the Cosi, nor funereal cypress (an introduced plant, however) west of the Teesta (in Sikkim). Of the twelve [1] Sikkim and Bhotan *Coniferæ* (including yew, junipers, and *Podocarpus*) eight are common to the North-west Himalaya (west of Nepal), and four [2] are not: of the thirteen natives of the north-west provinces, again, only five [3] are not found in Sikkim, and I have given their names below, because they show how European the absent ones are, either specifically or in affinity. I have stated that the Deodar is possibly a variety of the Cedar of Lebanon. This now a prevalent opinion, which is strengthened by the fact that so many more Himalayan plants are now ascertained to be European than had been supposed before they were compared with European specimens; such are the yew, *Juniperus communis*, *Berberis vulgaris*, *Quercus Ballota*, *Populus alba* and *Euphratica*, &c. The cones of the Deodar are identical with those of the Cedar of Lebanon: the Deodar has generally longer and more pale bluish leaves and weeping branches,[4] but these characters seem to be unusually developed

[1] Juniper, 3; yew, *Abies Webbiana*, *Brunoniana*, and *Smithiana*: Larch, *Pinus excelsa*, and *longifolia*, and *Podocarpus neriifolia*.

[2] Larch, *Cupressus funebris*, *Podocarpus neriifolia*, *Abies Brunoniana*.

[3] A juniper (the European *communis*), Deodar (possibly only a variety of the Cedar of Lebanon and of Mount Atlas), *Pinus Gerardiana*, *P. excelsa*, and *Cupressus torulosa*.

[4] Since writing the above, I have seen, in the magnificent Pinetum at

in our gardens; for several gentlemen, well acquainted with the Deodar at Simla, when asked to point it out in the Kew Gardens, have indicated the cedar of Lebanon, and when shown the Deodar, declare that they never saw that plant in the Himalaya!

At the bottom of the valley we turned up the stream, and passing the Tassichooding convents [1] and temple, crossed the river—which was a furious torrent, about twelve yards wide—to the village of Kambachen, on a flat terrace a few feet above the stream. There were about a dozen houses of wood, plastered with mud and dung, scattered over a grassy plain of a few acres, fenced in, as were also a few fields, with stone dykes. The only cultivation consists of radishes, potatos, and barley: no wheat is grown, the climate being said to be too cold for it, by which is probably meant that it is foggy,—the elevation (11,380 feet) being 2,000 feet less than that of the Yangma village, and the temperature therefore 6° to 7° warmer; but of all the mountain gorges I have ever visited, this is by far the wildest, grandest, and most gloomy; and that man should hybernate here is indeed extraordinary, for there is no route up the valley, and all communication with Lelyp,[2] two marches down the river, is cut off in winter, when the houses are buried in snow, and drifts fifteen feet deep are said to be common. Standing on the little flat of Kambachen, precipices, with inaccessible patches of pine wood, appeared to the west, towering over head; while across the narrow valley wilder and less wooded crags rose in broken ridges to the glaciers of Nango. Up the valley, the view was cut off by bluff cliffs; whilst down it, the scene was most remarkable:

Dropmore, noble cedars, with the length and hue of leaf, and the pensile branches of the Deodar, and far more beautiful than that is, and as unlike the common Lebanon Cedar as possible. When it is considered from how very few wild trees (and these said to be exactly alike) the many dissimilar varieties of the *C. Libani* have been derived; the probability of this, the Cedar of Algiers, and of the Himalayas (Deodar) being all forms of one species, is greatly increased. We cannot presume to judge from the few cedars which still remain, what the habit and appearance of the tree may have been, when it covered the slopes of Libanus, and seeing how very variable *Coniferæ* are in habit, we may assume that its surviving specimens give us no information on this head. Should all three prove one, it will materially enlarge our ideas of the distribution and variation of species. The botanist will insist that the typical form of cedar is that which retains its characters best over the greatest area, namely, the Deodar; in which case the prejudice of the ignorant, and the preconceived ideas of the naturalist, must yield to the fact that the old familiar Cedar of Lebanon is an unusual variety of the Himalayan Deodar.

[1] These were built by the Sikkim people, when the eastern valleys of Nepal belonged to the Sikkim rajah.

[2] Which I passed, on the Tambur, on the 21st Nov.

enormous black, round-backed moraines, rose, tier above tier, from a flat lake-bed, apparently hemming in the river between the lofty precipices on the east flank of the valley. These had all been deposited at the mouth of a lateral valley, opening just below the village, and descending from Junnoo, a mountain of 25,312 feet elevation, and one of the grandest of the Kinchinjunga group, whose top—though only five miles distant in a straight line—rises 13,932 feet[1] above the village. Few facts show more decidedly the extraordinary steepness and depth of the Kambachen valley near the village, which, though nearly 11,400 feet above the sea, lies between two mountains only eight miles apart, the one 25,312 feet high, the other (Nango), 19,000 feet.

The villagers received us very kindly, and furnished us with a guide for the Choonjerma pass, leading to the Yalloong valley, the most easterly in Nepal; but he recommended our not attempting any part of the ascent till the morrow, as it was past 1 P.M., and we should find no camping-ground for half the way up. The villagers gave us the leg of a musk deer, and some red potatos, about as big as walnuts—all they could spare from their winter-stock. With this scanty addition to our stores we started down the valley, for a few miles alternately along flat lake-beds and over moraines, till we crossed the stream from the lateral valley, and ascending a little, camped on its bank, at 11,400 feet elevation.

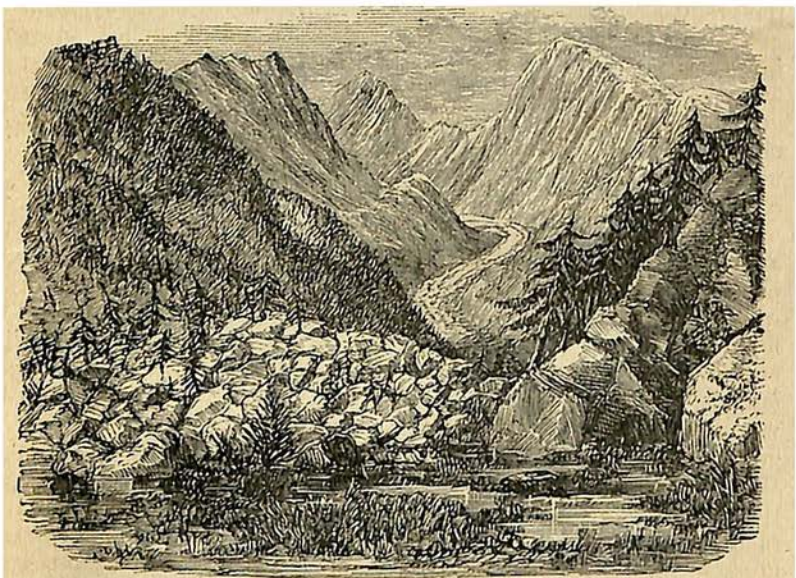
In the afternoon I botanized amongst the moraines, which were very numerous, and had been thrown down at right-angles to the main valley, which latter being here very narrow, and bounded by lofty precipices, must have stopped the parent glaciers, and effected the heaping of some of these moraines to at least 1,000 feet above the river. The general features were modifications of those seen in the Yangma valley, but contracted into a much smaller space.

The moraines were all accumulated in a sort of delta, through which the lateral river debouched into the Kambachen, and were all deposited more or less parallel to the course of the lateral valley, but curving outwards from its mouth. The village flat, or terrace, continued level to the first moraine, which had been

[1] This is one of the most sudden slopes in this part of the Himalaya, the angle between the top of Junnoo and Kambachen being 2,786 feet per mile, or 1 in 1·8. The slope from the top of Mont Blanc to the Chamouni valley is 2,464 feet per mile, or 1 in 2·1. That from Monte Rosa top to Macugnaga greatly exceeds either.

thrown down on the upper or north side of the lateral valley, on whose steep flanks it abutted, and curving outwards seemed to encircle the village-flat on the south and west; where it dipped into the river. This was crossed at the height of about 100 feet, by a stony path, leading to the bed of the rapid torrent flowing through shingle and boulders, beyond which was another moraine, 250 feet high, and parallel to it a third gigantic one.

Ascending the great moraine at a place where it overhung the main river, I had a good *coup-d'œil* of the whole. The view south-east up the glacial valley—(represented in the accom-



ANCIENT MORAINES IN THE KAMBACHEN VALLEY.

panying cut)—to the snowy peaks south of Junnoo, was particularly grand, and most interesting from the precision with which one great distant existing glacier was marked by two waving parallel lines of lateral moraines, which formed, as it were, a vast raised gutter, or channel, ascending from perhaps 16,000 feet elevation, till it was hidden behind a spur in the valley. With a telescope I could descry many similar smaller glaciers, with huge accumulations of shingle at their terminations; but this great one was beautifully seen by the naked eye, and formed a very curious feature in the landscape.

Between the moraines, near my tent, the soil was perfectly level, and consisted of little lake-beds strewn with gigantic boulders, and covered with hard turf of grass and sedge, and little bushes of dwarf rhododendron and prostrate juniper, as trim as if they had been clipped. Altogether these formed the most picturesque little nooks it was possible to conceive; and they exhibited the withered remains of so many kinds of primrose, gentian, anemone, potentilla, orchis, saxifrage, parnassia, campanula, and pedicularis, that in summer they must be perfect gardens of wild flowers. Around each plot of a few acres was the grand ice-transported girdle of stupendous rocks, many from 50 to 100 feet long, crested with black tabular-branched silver firs, conical deep green tree-junipers, and feathery larches; whilst amongst the blocks grew a profusion of round masses of evergreen rhododendron bushes. Beyond were stupendous frowning cliffs, beneath which the river roared like thunder; and looking up the glacial valley, the setting sun was bathing the expanse of snow in the most delicate changing tints, pink, amber, and gold.

The boulders forming the moraine were so enormous and angular, that I had great difficulty in ascending it. I saw some pheasants feeding on the black berries of the juniper, but where the large rhododendrons grew amongst the rocks I found it impossible to penetrate. The largest of the moraines is piled to upwards of 1,000 feet against the south flank of the lateral valley, and stretched far up it beyond my camp, which was in a grove of silver firs. A large flock of sheep and goats, laden with salt, overtook us here on their route from Wallanchoon to Yalloong. The sheep I observed to feed on the *Rhododendron Thomsoni* and *campylocarpum*. On the roots of one of the latter species a parasitical Broom-rape (*Orobanche*) grew abundantly; and about the moraines were more mosses, lichens, &c., than I have elsewhere seen in the loftier Himalaya, encouraged no doubt by the dampness of this grand mountain gorge, which is so hemmed in that the sun never reaches it until four or five hours after it has gilded the overhanging peaks.

December 5.—The morning was bright and clear, and we left early for the Choonjerma pass. I had hoped the route would be up the magnificent glacier-girdled valley in which we had encamped; but it lay up another, considerably south of it, and to which we crossed, ascending the rocky moraine, in the clefts of which grew abundance of a common Scotch fern, *Cryptogramma crispa*.

The clouds early commenced gathering, and it was curious to watch their rapid formation in coalescing streaks, which became first cirrhi, and then stratus, being apparently continually added to from below by the moisture-bringing southerly wind. Ascending a lofty spur, 1,000 feet above the valley, against which the moraine was banked, I found it to be a distinct anticlinal axis. The pass, bearing north-west, and the valley we had descended on the previous day, rose immediately over the curved strata of quartz, topped by the glacier-crowned mountain of Nango, with four glaciers descending from its perpetual snows. The stupendous cliffs on its flanks, under which I had camped on the previous night, were very grand, but not more so than those which dipped into the chasm of the Kambachen below. Looking up the valley of the latter, was another wilderness of ice full of enormous moraines, round the bases of which the river wound.

Ascending, we reached an open grassy valley, and overtook the Tibetans who had preceded us, and who had halted here to feed their sheep. A good-looking girl of the party came to ask me for medicine for her husband's eyes, which had suffered from snow-blindness: she brought me a present of snuff, and carried a little child, stark naked, yet warm from the powerful rays of the sun, at nearly 14,000 feet elevation, in December! I prescribed for the man, and gave the mother a bright farthing to hang round the child's neck, which delighted the party. My watch was only wondered at; but a little spring measuring-tape that rolled itself up, struck them dumb, and when I threw it on the ground with the tape out, the mother shrieked and ran away, while the little savage howled after her.

Above, the path up the ascent was blocked with snow-beds, and for several miles we alternately scrambled among rocks and over slippery slopes, to the top of the first ridge, there being two to cross. The first consisted of a ridge of rocks running east and west from a superb sweep of snowy mountains to the north-west, which presented a chaotic scene of blue glacial ice and white snow, through which splintered rocks and beetling crags thrust their black heads. The view into the Kambachen gorge was magnificent, though it did not reveal the very bottom of the valley and its moraines: the black precipices of its opposite flank seemed to rise to the glaciers of Nango, fore-shortened into snow-capped precipices 5,000 feet high, amongst which lay the Kambachen pass, bearing north-west by north. Lower down the valley appeared a broad flat, called Jubla, a halting-place one

stage below the village of Kambachen, on the road to Lelyp on the Tambur: it must be a remarkable geological as well as natural feature, for it appeared to jut abruptly and quite horizontally from the black cliffs of the valley.

Looking north, the conical head of Junnoo was just scattering the mists from its snowy shoulders, and standing forth to view, the most magnificent spectacle I ever beheld. It was quite close to me, bearing north-east by east, and subtending an angle of 12° 23, and is much the steepest and most conical of all the peaks of these regions. From whichever side it is viewed, it rises 9,000 feet above the general mountain mass of 16,000 feet elevation, towering like a blunt cone, with a short saddle on one side, that dips in a steep cliff: it appeared as if uniformly snowed, from its rocks above 20,000 feet (like those of Kinchinjunga) being of white granite, and not contrasting with the snow. Whether the top is stratified or not, I cannot tell, but waving parallel lines are very conspicuous near it, as shown in the accompanying view.[1]

Looking south, as evening drew on, another wonderful spectacle presented itself, similar to that which I described at Sakkiazung, but displayed here on an inconceivably grander scale, with all the effects exaggerated. I saw a sea of mist floating 3,000 feet beneath me, just below the upper level of the black pines; the magnificent spurs of the snowy range which I had crossed rising out of it in rugged grandeur as promontories and peninsulas, between which the misty ocean seemed to finger up like the fiords of Norway, or the salt-water lochs of the west of Scotland; whilst islets tailed off from the promontories, rising here and there out of the deceptive elements. I was so high above this mist, that it had not the billowy appearance I saw before, but was a calm unruffled ocean, boundless to the south and west, where the horizon over-arched it. A little to the north of west I discerned the most lofty group of mountains in Nepal[2] (mentioned

[1] The appearance of Mont Cervin, from the Riffelberg, much reminded me of that of Junnoo, from the Choonjerma pass, the former bearing the same relation to Monte Rosa that the latter does to Kinchinjunga. Junnoo, though incomparably the more stupendous mass, not only rising 10,000 feet higher above the sea, but towering 4,000 feet higher above the ridge on which it is supported, is not nearly so remarkable in outline, so sharp, or so peaked as is Mont Cervin: it is a very much grander, but far less picturesque object. The whiteness of the sides of Junnoo adds also greatly to its apparent altitude; while the strong relief in which the black cliffs of Mont Cervin protrude through its snowy mantle greatly diminish both its apparent height and distance.

[2] Called Tsungau by the Bhoteeas. Junnoo is called Kumbo-Kurma by the Hill-men of Nepal (the Mont Everest group).

previously), beyond Kinchinjunga, which I believe are on the west flank of the great valley through which the Arun river enters Nepal from Tibet: they were very distant, and subtended so small an angle, that I could not measure them with the sextant and artificial horizon: their height, judging from the quantity of snow, must be prodigious.

From 4 to 5 P.M. the temperature was 24°, with a very cold wind; the elevation by the barometer was 15,260 feet, and the dew-point 10½°, giving the humidity 0.610, and the amount of vapour 1.09 grains in a cubic foot of air; the same elements at Calcutta, at the same hour, being thermometer 66½°, dew-point 60½°, humidity 0·840, and weight of vapour 5·9 grains.

I waited for an hour, examining the rocks about the pass, till the coolies should come up, but saw nothing worthy of remark, the natural history and geology being identical with those of Kambachen pass: I then bade adieu to the sublime and majestic peak of Junnoo. Thence we continued at nearly the same level for about four miles, dipping into the broad head of a snowy valley, and ascending to the second pass, which lay to the south-east.

On the left I passed a very curious isolated pillar of rock, amongst the wild crags to the north-east, whose bases we skirted: it resembles the Capuchin on the shoulder of Mont Blanc, as seen from the Jardin. Evening overtook us while still on the snow near the last ascent. As the sun declined, the snow at our feet reflected the most exquisitely delicate peach-bloom hue; and looking west from the top of the pass, the scenery was gorgeous beyond description, for the sun was just plunging into a sea of mist, amongst some cirrhi and stratus, all in a blaze of the ruddiest coppery hue. As it sank, the Nepal peaks to the right assumed more definite, darker, and gigantic forms, and floods of light shot across the misty ocean, bathing the landscape around me in the most wonderful and indescribable changing tints. As the luminary was vanishing, the whole horizon glowed like copper run from a smelting furnace, and when it had quite disappeared, the little inequalities of the ragged edges of the mist were lighted up and shone like a row of volcanos in the far distance. I have never before or since seen anything, which for sublimity, beauty, and marvellous effects, could compare with what I gazed on that evening from Choonjerma pass. In some of Turner's pictures I have recognized similar effects, caught and fixed by a marvellous effort of genius; such are the fleeting hues over the ice, in his

"Whalers," and the ruddy fire in his "Wind, Steam, and Rain," which one almost fears to touch. Dissolving views give some idea of the magic creation and dispersion of the effects, but any combination of science and art can no more recall the scene, than it can the feelings of awe that crept over me, during the hour I spent in solitude amongst these stupendous mountains.

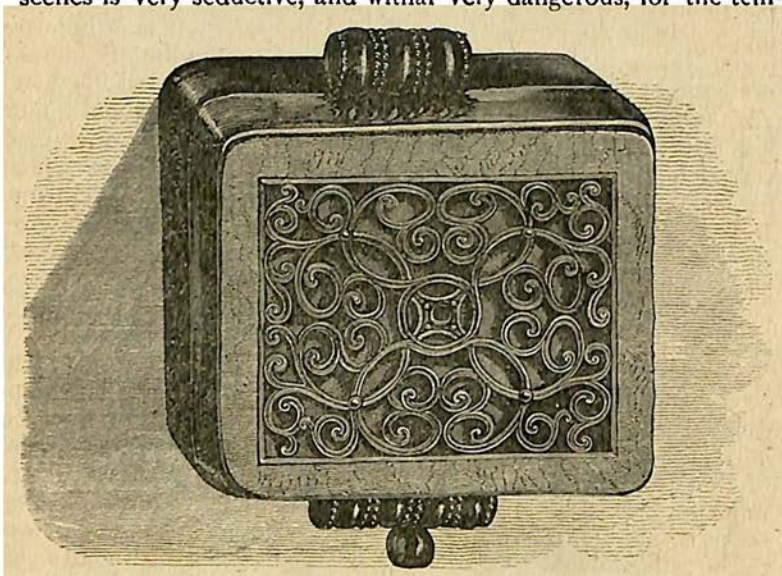
The moon guided us on our descent, which was to the south, obliquely into the Yalloong valley. I was very uneasy about the coolies, who were far behind, and some of them had been frost-bitten in crossing the Kambachen pass. Still I thought the best thing was to push on, and light large fires at the first juniper we should reach. The change, on passing from off the snow to the dark earth and rock, was so bewildering, that I had great difficulty in picking my way. Suddenly we came on a flat with a small tarn, whose waters gleamed illusively in the pale moonlight: the opposite flanks of the valley were so well reflected on its gloomy surface, that we were at once brought to a standstill on its banks: it looked like a chasm, and whether to jump across it, or go down it, or along it, was the question, so deceptive was the spectral landscape. Its true nature was, however, soon discovered, and we proceeded round it, descending. Of course there was no path, and after some perplexity amongst rocks and ravines, we reached the upper limit of wood, and halted by some bleached juniper-trees, which were soon converted into blazing fires.

I wandered away from my party to listen for the voices of the men who had lingered behind, about whom I was still more anxious, from the very great difficulty they would encounter if, as we did, they should get off the path. The moon was shining clearly in the black heavens; and its bright light, with the pale glare of the surrounding snow, obscured the milky way, and all the smaller stars; whilst the planets appeared to glow with broader orbs than elsewhere, and the great stars flashed steadily and periodically.

Deep black chasms seemed to yawn below, and cliffs rose on all sides, except down the valley, where looking across the Yalloong river, a steep range of mountains rose, seamed with torrents that were just visible like threads of silver coursing down broad land-slips. It was a dead calm, and nothing broke the awful silence but the low hoarse murmur of many torrents, whose mingled voices rose and fell as if with the pulsations of the atmosphere; the undulations of which appeared thus to be marked by the ear

alone. Sometimes it was the faintest possible murmur, and then it rose swelling and filling the air with sound : the effect was that of being raised from the earth's surface, and again lowered to it ; or that of waters advancing and retiring. In such scenes and with such accompaniments, the mind wanders from the real to the ideal, the larger and brighter lamps of heaven lead us to imagine that we have risen from the surface of our globe and are floating through the regions of space, and that the ceaseless murmur of the waters is the Music of the Spheres.

Contemplation amid such soothing sounds and impressive scenes is very seductive, and withal very dangerous, for the tem-



TIBETAN CHARM-BOX.

perature was at freezing-point, my feet and legs were wet through, and it was well that I was soon roused from my reveries by the monosyllable exclamations of my coolies. They were quite knocked up, and came along grunting, and halting every minute to rest, by supporting their loads, still hanging to their backs, on their stout staves. I had still one bottle of brandy left, with which to splice the main brace. It had been repeatedly begged for in vain, and being no longer expected, was received with unfeigned joy. Fortunately with these people a little spirits goes a long way, and I kept half for future emergencies.

We camped at 13,290 feet; the air was calm and mild to the feeling, though the temperature fell to 22¾°. On the following morning we saw two musk-deer,[1] called "Kosturah" by the mountaineers. The musk, which hangs in a pouch near the navel of the male, is the well-known object of traffic with Bengal. This creature ranges between 8,000 and 13,000 feet, on the Himalaya, often scenting the air for many hundred yards. It is a pretty grey animal, the size of a roebuck, and something resembling it, with coarse fur, short horns, and two projecting teeth from the upper jaw, said to be used in rooting up the aromatic herbs from which the Bhoteeas believe that it derives the odour of musk. This I much doubt, because the animal never frequents those very lofty regions where the herbs supposed to provide the scent are found, nor have I ever seen signs of any having been so rooted up. The *Delphinium glaciale* smells strongly and disagreeably of musk, but it is one of the most alpine plants in the world, growing at an elevation of 17,000 feet, far above the limits of Kosturah. The female and young male are very good eating, much better than any Indian venison I ever tasted, being sweet and tender. Mr. Hodgson once kept a female alive, but it was very wild, and continued so as long as I knew it. Two of my Lepchas gave chase to these animals, and fired many arrows in vain after them: these people are fond of carrying a bow, but are very poor shots.

We descended 3,000 feet to the deep valley of the Yalloong river which runs west-by-south to the Tambur, from between Junnoo and Kubra: the path was very bad, over quartz, granite, and gneiss, which cut the shoes and feet severely. The bottom of the valley, which is elevated 10,450 feet, was filled with an immense accumulation of angular gravel and débris of the above rocks, forming on both sides of the river a terrace 400 feet above the stream, which flowed in a furious torrent. The path led over this deposit for a good many miles, and varied exceedingly in height, in some places being evidently increased by landslips, and at others apparently by moraines.

[1] There are two species of musk-deer in the Himalaya, besides the Tibetan kind, which appears identical with the Siberian animal originally described by Pallas.

CHAPTER XII.

Yalloong valley—Find Kanglanamo pass closed—Change route for the southward—*Picrorhiza*—View of Kubra—*Rhododendron Falconeri*—Yalloong river—Junction of gneiss and clay-slate—Cross Yalloong range—View—Descent—Yew—Vegetation—Misty weather—Tongdam village—Khabang—Tropical vegetation—Sidingbah Mountain—View of Kinchinjunga—Yangyading village—Slopes of hills, and courses of rivers—Khabili valley—Ghorkha Havildar's bad conduct—Ascend Singalelah—Plague of ticks—Short commons—Cross Islumbo pass—Boundary of Sikkim—Kulhait valley—Lingcham—Reception by Kajee—Hear of Dr. Campbell's going to meet Rajah—Views in valley—Leave for Teesta river—Tipsy Kajee—Hospitality—Murwa beer—Temples—*Acorus Calamus*—Long Mendong—Burning of dead—Superstitions—Cross Great Rungeet—Boulders, origin of—Purchase of a dog—Marshes—Lamas—Dismiss Ghorkhas—Bhoteea house—Murwa beer.

On arriving at the bottom we found a party who were travelling with sheep laden with salt; they told us that the Yalloong village, which lay up the valley on the route to the Kanglanamo pass (leading over the south shoulder of Kubra into Sikkim) was deserted, the inhabitants having retired after the October fall of snow to Yankutang, two marches down; also that the Kanglanamo pass was impracticable, being always blocked up by the October fall. I was, therefore, reluctantly obliged to abandon the plan of pursuing that route to Sikkim, and to go south, following the west flank of Singalelah to the first of the many passes over it which I might find open.

These people were very civil, and gave me a handful of the root of one of the many bitter herbs called in Bengal "Teeta," and used as a febrifuge: the present was that of *Picrorhiza*, a plant allied to Speedwell, which grows at from 12,000 to 15,000 feet elevation, and is a powerful bitter, called "Hoonling" by the Tibetans. They had with them above 100 sheep, of a tall, long-legged, roman-nosed breed. Each carried upwards of forty pounds of salt, done up in two leather bags, slung on either side, and secured by a band going over the chest, and another round the loins, so that they cannot slip off, when going up or down hill. These sheep are very tame, patient creatures, travelling twelve miles a day with great ease, and being indifferent to rocky or steep ground.

Looking east I had a splendid view of the broad snowy mass of Kubra, blocking up, as it were, the head of the valley with a white screen. Descending to about 10,000 feet, the *Abies Brunoniana* appeared, with fine trees of *Rhododendron Falconeri* forty feet high,

and with leaves nineteen inches long! while the upper part of the valley was full of *Abies Webbiana.*

At the elevation of 9,000 feet, we crossed to the east bank, and passed the junction of the gneiss and mica slate: the latter crossed the river, striking north-west, and the stream cut a dark chasm-like channel through it, foaming and dashing the spray over the splintered ridges, and the broad water-worn hog-backed masses that projected from its bed. Immense veins of granite permeated the rocks, which were crumpled in the strangest manner: isolated angular blocks of schist had been taken up by the granite in a fluid state, and remained imbedded in it.

The road made great ascents to avoid landslips, and to surmount the enormous piles of débris which encumber this valley more than any other. We encamped at 10,050 feet, on a little flat 1,000 feet above the bed of the river, and on its east flank. A *Hydrangea* was the common small wood, but *Abbies Webbiana* formed the forest, with great Rhododendrons. The weather was foggy, whence I judged that we were in the sea of mist I saw beneath me from the passes; the temperature, considering the elevation, was mild, 37° and 38°, which was partly due to the evolution of heat that accompanies the condensation of these vapours, the atmosphere being loaded with moisture. The thermometer fell to 28° during the night, and in the morning the ground was thickly covered with hoar-frost.

December 7.—We ascended the Yalloong ridge to a saddle 11,000 feet elevation, whence the road dips south to the gloomy gorges of the eastern feeders of the Tambur. Here we bade adieu to the grand alpine scenery, and for several days our course lay in Nepal in a southerly direction, parallel to Singalelah, and crossing every spur and river sent off by that mighty range. The latter flow towards the Tambur, and their beds for forty or fifty miles are elevated about 3,000 or 4,000 feet. Few of the spurs are ascended above 5,000 feet, but all of them rise to 12,000 or 14,000 feet to the westward, where they join the Singalelah range.

I clambered to the top of a lofty hummock, through a dense thicket of interwoven Rhododendron bushes, the clayey soil under which was slippery from the quantity of dead leaves. I had hoped for a view of the top of Kinchinjunga, which bore north-east, but it was enveloped in clouds, as were all the snows in that direction; to the north-west, however, I obtained bearings of the principal peaks, &c., of the Yangma and Kambachen valleys. To the south and south-east, lofty, rugged and pine-clad mountains rose in confused masses, and white sheets of mist came driving up, clinging

to the mountain-tops, and shrouding the landscape with extreme rapidity. The remarkable mountain of Sidingbah bore south-south-east, raising its rounded head above the clouds. I could, however, procure no other good bearing.

The descent from the Yalloong ridge to the Khabili feeders of the Tambur was very steep, and in some places almost precipitous, first through dense woods of silver fir, with *Rhod. Falconeri* and *Hodgsoni*, then through *Abies Brunoniana*, with yew (now covered with red berries) to the region of Magnolias and *Rhod. arboreum* and *barbatum*. One bush of the former was in flower, making a gorgeous show. Here also appeared the great oak with lamellated acorns, which I had not seen in the drier valleys to the westward; with many other Darjeeling trees and shrubs. A heavy mist clung to the rank luxuriant foliage, tantalising from its obscuring all the view. Mica schist replaced the gneiss, and a thick slippery stratum of clay rendered it very difficult to keep one's footing. After so many days of bright sunshine and dry weather, I found this quiet, damp, foggy atmosphere to have a most depressing effect: there was little to interest in the meteorology, the atmospheric fluctuations being far too small; geographical discovery was at an end, and we groped our way along devious paths in wooded valleys, or ascended spurs and ridges, always clouded before noon, and clothed with heavy forest.

At 6,000 feet we emerged from the mist, and found ourselves clambering down a deep gully, hemmed in by frightful rocky steeps, which exposed a fine and tolerably continuous section of schistose rocks, striking north-west, and dipping north-east, at a very high angle.

At the bottom three furious torrents met: we descended the course of one of them, over slanting precipices, or trees lashed to the rocks, and after a most winding course our path conducted us to the village of Tarbu, high above a feeder of the Khabili river, which flows west, joining the Tambur three days' march lower down. Having no food, we had made a very long and difficult march to this place, but finding none here, proceeded on to Tonghem village on the Khabili, descending through thickets of *Rhod. arboreum* to the elevation of 5,560.

This village, or spur, called "Tonghem" by the Limboos, and "Yankutang" by the Bhoteeas, is the winter resort of the inhabitants of the upper Yalloong valley: they received us very kindly, sold us two fowls, and rice enough to last for one or two days, which was all they could spare, and gave me a good deal of information. I found that the Kanglanamo pass had been disused

since the Nepal war, that it was very lofty, and always closed in October.

The night was fine, clear and warm, but the radiation so powerful that the grass was coated with ice the following morning, though the thermometer did not fall below 33°. The next day the sun rose with great power, and the vegetation reeked and steamed with the heat. Crossing the river, we first made a considerable descent, and then ascended a ridge to 5,750 feet, through a thick jungle of *Camellia*, *Eurya*, and small oak: from the top I obtained bearings of Yalloong and Choonjerma pass, and had also glimpses of the Kinchin range through a tantalising jungle; after which a very winding and fatiguing up-and-down march southwards brought us to the village of Khabang, in the magnificent valley of the Tawa, about 800 feet above the river, and 5,500 feet above the sea.

I halted here for a day, to refresh the people, and if possible to obtain some food. I hoped, too, to find a pass into Sikkim, east over Singalelah, but was disappointed: if there had ever been one, it had been closed since the Nepal war; and there was none, for several marches further south, which would conduct us to the Iwa branch of the Khabili.

Khabang is a village of Geroongs, or shepherds, who pasture their flocks on the hills and higher valleys during the summer, and bring them down to this elevation in the winter: the ground was consequently infested with a tick, equal in size to that so common in the bushes, and quite as troublesome, but of a different species.

The temperature rose to 72°, and the black-bulb thermometer to 140°. Magnolias and various almost tropical trees were common, and the herbaceous vegetation was that of low elevations. Large sugar-cane (*Saccharum*), palm (*Wallichia*), and wild plantains grew near the river, and *Rhod. arboreum* was very common on dry slopes of mica-slate rocks, with the gorgeous and sweet-scented *Luculia gratissima*.

Up the valley of the Tawa the view was very grand of a magnificent rocky mountain called Sidingbah, bearing south-east by south, on a spur of the Singalelah range that runs westerly, and forms the south flank of the Tawa, and the north of the Khabili valleys. This mountain is fully 12,000 feet high, crested with rock and ragged black forest, which, on the north flank, extends to its base: to the eastward, the bare ridges of Singalelah were patched with snow, below which they too were clothed with black pines.

From the opposite side of the Tawa to Khabang (alt. 6,020

feet), I was, during our march southwards, most fortunate in obtaining a splendid view of Kinchinjunga (bearing north-east by north), with its associates, rising over the dark mass of Singalelah, its flanks showing like tier above tier of green glaciers: its distance was fully-twenty-five miles, and as only about 7,000 or 8,000 feet from its summit were visible, and Kubra was foreshortened against it, its appearance was not grand; added to which, its top was round and hummocky, not broken into peaks, as when seen from the south and east. Villages and cultivation became more frequent as we proceeded southward, and our daily marches were up ridges, and down into deep valleys, with feeders from the flanks of Sidingbah to the Tambur. We passed through the village of Tchonboong, and camped at Yangyading (4,100 feet), sighted Yamroop, a large village and military post to the west of our route, crossed the Pangwa river, and reached the valley of the Khabili. During this part of the journey, I did not once see the Tambur river, though I was day after day marching only seven to ten miles distant from it, so uneven is the country. The mountains around Taptiatok, Mywa Guola, and Chingtam, were pointed out to me, but they presented no recognizable feature.

I often looked for some slope, or strike of the slopes of the spurs, in any one valley, or that should prevail through several, but could seldom trace any, except on one or two occasions, at low elevations. Looking here across the valleys, there was a tendency in the gentle slopes of the spurs to have plane faces dipping north-east, and to be bounded by a line of cliffs striking north-west, and facing the south-east. In such arrangements, the upheaved cliffs may be supposed to represent parallel lines of faults, dislocation, or rupture, but I could never trace any secondary valleys at right angles to these. There is no such uniformity of strike as to give to the rivers a zig-zag course of any regularity, or one having any apparent dependence on a prevailing arrangement of the rocks; for, though the strike of the chlorite and clay-slate at elevations below 6,000 feet along its course is certainly north-west, with a dip to north-east, the flexures of the river, as projected on the map, deviate very widely from these directions.

The valley of the Khabili is very grand, broad, open, and intersected by many streams and cultivated spurs: the road from Yamroop to Sikkim, once well frequented, runs up its north flank, and though it was long closed we determined to follow and clear it.

On the 11th of December we camped near the village of

Sablakoo (4,680 feet), and procured five days' food, to last us as far as the first Sikkim village. Thence we proceeded eastward up the valley, but descending to the Iwa, an affluent of the Khabili, through a tropical vegetation of *Pinus longifolia*, *Phyllanthus Emblica*, dwarf date-palm, &c.

Gneiss was here the prevailing rock, uniformly dipping north-east 20°, and striking north-west. The same rock no doubt forms the mass Sidingbah, which reared its head 8,000 feet above the Iwa river, by whose bed we camped at 3,780 feet. Sand-flies abounded, and were most troublesome: troops of large monkeys were skipping about, and the whole scene was thoroughly tropical; still, the thermometer fell to 38° in the night, with heavy dew.

Though we passed numerous villages, I found unusual difficulty in getting provision, and received none of the presents so uniformly brought by the villagers to a stranger. I was not long in discovering, to my great mortification, that these were appropriated by the Ghorkha Havildar, who seemed to have profited by our many days of short allowance, and diverted the current of hospitality from me to himself. His coolies I saw groaning under heavy burdens, when those of my people were light; and the truth only came out when he had the impudence to attempt to impose a part of his coolies' loads on mine, to enable the former to carry more food, whilst he was pretending that he used every exertion to procure me a scanty supply of rice with my limited stock of money. I had treated this man and his soldiers with the utmost kindness, even nursing them and clothing them from my own stock of flannels, when sick and shivering amongst the snows. Though a high caste Hindoo, and one who assumed Brahmin rank, he had, I found, no objection to eat forbidden things in secret; and now that we were travelling amongst Hindoos, his caste obtained him everything, while money alone availed me. I took him roundly to task for his treachery, which caused him secretly to throw away a leg of mutton he had concealed; I also threatened to expose the humbug of his pretension to caste, but it was then too late to procure more food. Having hitherto much liked this man, and fully trusted him, I was greatly pained by his conduct.

We proceeded east for three days, up the valley, through gloomy forests of tropical trees below 5,000 feet; and ascended to oaks and magnolias at 6,000 feet. The path was soon obstructed, and we had to tear and cut our way, from 6,000 to 10,000 feet, which took two days' very hard work. Ticks swarmed in the

small bamboo jungle, and my body was covered with these loathsome insects, which got into my bed and hair, and even attached themselves to my eyelids during the night, when the constant annoyance and irritation completely banished sleep. In the daytime they penetrated my trousers, piercing to my body in many places, so that I repeatedly took off as many as twelve at one time. It is indeed marvellous how so large an insect can painlessly insert a stout barbed proboscis, which requires great force to extract it, and causes severe smarting in the operation. What the ticks feed upon in these humid forests is a perfect mystery to me, for from 6,000 to 9,000 feet they literally swarmed, where there was neither path nor animal life. They were, however, more tolerable than a commoner species of parasite, which I found it impossible to escape from, all classes of mountaineers being infested with it.

On the 14th, after an arduous ascent through the pathless jungle, we camped at 9,300 feet on a narrow spur, in a dense forest, amongst immense loose blocks of gneiss. The weather was foggy and rainy, and the wind cold. I ate the last supply of animal food, a miserable starved pullet, with rice and Chili vinegar; my tea, sugar, and all other superfluities having been long before exhausted.

On the following morning we crossed the Islumbo pass over Singalelah into Sikkim, the elevation being 11,000 feet. Above our camp the trees were few and stunted, and we quickly emerged from the forest on a rocky and grassy ridge, covered with withered *Saxifrages*, *Umbelliferæ*, *Parnassia*, *Hypericum*, &c. There were no pines on either side of the pass; a very remarkable peculiarity of the damp mountains of Sikkim, which I have elsewhere had occasion to notice: we had left *Pinus longifolia* (a far from common tree in these valleys) at 3,000 feet in the Tawa three days before, and ascended to 11,000 feet without passing a coniferous tree of any kind, except a few yews, at 9,000 feet, covered with red berries.

The top of the pass was broad, grassy, and bushy with dwarf Bamboo, Rose, and Berberry, in great abundance, covered with mosses and lichens: it had been raining hard all the morning, and the vegetation was coated with ice: a dense fog obscured everything, and a violent south-east wind blew over the pass in our teeth. I collected some very curious and beautiful mosses, putting these frozen treasures in my box, in the form of exquisitely beautiful glass ornaments, or mosses frosted with silver.

A few stones marked the boundary between Nepal and Sikkim,

where I halted for half an hour, and hung up my instruments: the temperature was 32°.

We descended rapidly, proceeding eastward down the broad valley of the Kulhait river, an affluent of the great Rungeet; and as it had begun to sleet and snow hard, we continued until we reached 6,400 feet before camping.

On the following day we proceeded down the valley, and reached habitations of 4,000 feet; passing many villages and much cultivation, we crossed the river, and ascended by 7 P.M. to the village of Lingcham, just below the convent of Changachelling, very tired and hungry. Bad weather had set in, and it was pitch dark and raining hard when we arrived; but the Kajee, or head man, had sent out a party with torches to conduct us, and he gave us a most hospitable reception, honoured us with a salute of musketry, and brought abundance of milk, eggs, fowls, plantains, and Murwa beer. Plenty of news was awaiting me here, and a messenger with letters was three marches further north, at Yoksun, waiting my expected return over the Kanglanamo pass. Dr. Campbell, I was told, had left Darjeeling, and was *en route* to meet the Rajah at Bhomsong on the Teesta river, where no European had ever yet been; and as the Sikkim authorities had for sixteen years steadily rejected every overture for a friendly interview, and even refused to allow the agent of the Governor-General to enter their dominions, it was evident that grave doings were pending. I knew that Dr. Campbell had long used every exertion to bring the Sikkim Rajah to a friendly conference, without having to force his way into the country for the purpose, but in vain. It will hardly be believed that though this chief's dominions were redeemed by us from the Nepalese and given back to him; though we had bound ourselves by a treaty to support him on his throne, and to defend him against the Nepalese on the west, the Bhotan people on the east, and the Tibetans on the north; and though the terms of the treaty stipulated for free intercourse, mutual protection, and friendship; the Sikkim authorities had hitherto been allowed to obstruct all intercourse, and in every way to treat the Governor-General's agent and the East India Company with contempt. An affectation of timidity, mistrust, and ignorance was assumed for the purpose of deception, and as a cloak for every insult and resistance to the terms of our treaty, and it was quoted by the Government in answer to every remonstrance on the part of their resident agent at Darjeeling.

On the following morning the Kajee waited on me with a mag-

nificent present of a calf, a kid, fowls, eggs, rice, oranges, plantains, egg-apples, Indian corn, yams, onions, tomatos, parsley, fennel, turmeric, rancid butter, milk, and, lastly, a coolie-load of fermenting millet-seeds, wherewith to make the favourite Murwa beer. In the evening two lads arrived from Darjeeling, who had been sent a week beforehand by my kind and thoughtful friend, Mr. Hodgson, with provisions and money.

The valley of the Kulhait is one of the finest in Sikkim, and it is accordingly the site of two of the oldest and richest conventual establishments. Its length is sixteen miles, from the Islumbo pass to the Great Rungeet, for ten of which it is inhabited, the villages being invariably on long meridional spurs that project north and south from either flank; they are about 2,000 feet above the river, and from 4,500 to 5,000 feet above the sea. Except where these spurs project, the flanks of the valley are very steep, the mountains rising to 7,000 or 8,000 feet.

Looking from any spur, up or down the valley, five or six others might be seen on each side of the river, at very nearly the same average level, all presenting great uniformity of contour, namely, a gentle slope towards the centre of the valley, and then an abrupt descent to the river. They were about a quarter of a mile broad at the widest, and often narrower, and a mile or so long; some parts of their surfaces and sides were quite flat, and occasionally occupied by marshes or ponds. Cultivation is almost confined to these spurs, and is carried on both on their summits and steep flanks; between every two is a very steep gully and water-course. The timber has long since been either wholly or partially cleared from the tops, but, to a great extent, still clothes their flanks and the intervening gorges. I have been particular in describing these spurs, because it is impossible to survey them without ascribing their comparative uniformity of level to the action of water. Similar ones are characteristic features of the valleys of Sikkim between 2,000 and 8,000 feet, and are rendered conspicuous by being always sites for villages and cultivation: the soil is a vegetable mould, over a deep stratum of red clay.

I am far from supposing that any geologically recent action of the sea has levelled these spurs; but as the great chain of the Himalaya has risen from the ocean, and as every part of it has been subjected to sea-action, it is quite conceivable that intervals of rest during the periods of elevation or submergence would effect their levelling. In a mountain mass so tumbled as is that of Sikkim, any level surface, or approach to it, demands study; and when, as in the Kulhait valley, we find several similar spurs

with comparatively flat tops, to occupy about the same level, it is necessary to look for some levelling cause. The action of denudation is still progressing with astonishing rapidity, under an annual fall of from 100 to 150 inches of rain; but its tendency is to obliterate all such phenomena, and to give sharp, rugged outlines to these spurs, in spite of the conservative effects of vegetation.

The weather at Lingcham was gloomy, cold, and damp, with much rain and fog, and the mean temperature (45¼°) was cold for the elevation (4,860 feet): 52½° was the highest temperature observed, and 39° the lowest.

A letter from Dr. Campbell reached me three days after my arrival, begging me to cross the country to the Teesta river, and meet him at Bhomsong, on its west bank, where he was awaiting my arrival. I therefore left on the 20th of December, accompanied by my friend the Kajee, who was going to pay his respects to the Rajah. He was constantly followed by a lad, carrying a bamboo of Murwa beer slung round his neck, with which he kept himself always groggy. His dress was thoroughly Lepcha, and highly picturesque, consisting of a very broad-brimmed round-crowned bamboo-platted hat, scarlet jacket, and blue-striped cloth shirt, bare feet, long knife, bow and quiver, rings and earrings, and a long pigtail. He spoke no Hindoostanee, but was very communicative through my interpreters.

Leaving the Lingcham spur, we passed steep cliffs of mica and schist, covered with brushwood and long grass, about 1,000 feet above which the Changachelling convent is perched. Crossing a torrent, we came to the next village, on the spur of Kurziuk, where I was met by a deputation of women, sent by the Lamas of Changachelling, bearing enormous loads of oranges, rice, milk, butter, ghee, and the everflowing Murwa beer.

The villagers had erected a shady bower for me to rest under, of leaves and branches, and had fitted up a little bamboo stage, on which to squat cross-legged as they do, or to hang my legs from, if I preferred: after conducting me to this, the parties advanced and piled their cumbrous presents on the ground, bowed, and retired; they were succeeded by the beer-carrier, who plunged a clean drinking-tube to the bottom of the steaming bamboo jug (described at p. 122), and held it to my mouth, then placing it by my side, he bowed and withdrew. Nothing can be more fascinating than the simple manners of these kind people, who really love hospitality for its own sake, and make the stranger feel himself welcome. Just now too, the Durbar had ordered every attention

to be paid me; and I hardly passed a village, however small, without receiving a present, or a cottage, where beer was not offered. This I found a most grateful beverage; and of the occasional rests under leafy screens during a hot day's march, and sips at the bamboo jug, I shall ever retain a grateful remembrance. Happily the liquor is very weak, and except by swilling, as my friend the Kajee did, it would be impossible to get fuddled by it.

At Kurziuk I was met by a most respectable Lepcha, who, as a sort of compliment, sent his son to escort us to the next village and spur of Pemiongchi, to reach which we crossed another gorge, of which the situation and features were quite similar to those of Kurziuk and Lingcham.

The Pemiongchi and Changachelling convents and temples stand a few miles apart, on the ridge forming the north flank of the Kulhait valley; and as they will be described hereafter, I now only allude to the village, which is fully 1,000 feet below the convent, and large and populous.

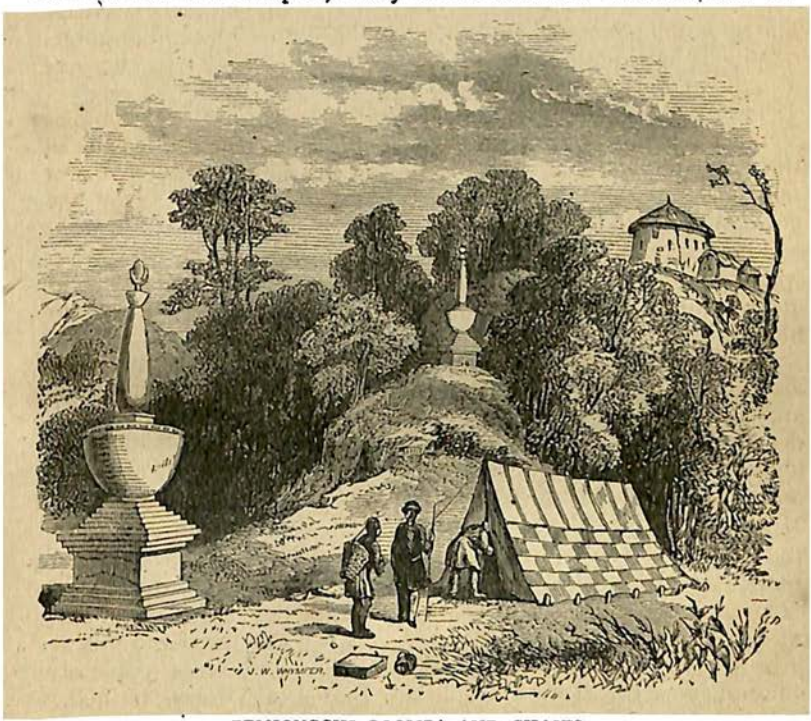
At Pemiongchi a superior Lama met me with another overwhelming present: he was a most jolly fat monk, shaven and girdled, and dressed in a scarlet gown; my Lepchas kotowed to him, and he blessed them by the laying on of hands.

There is a marsh on this spur, full of the common English *Acorus Calamus*, or sweet-flag, whose roots being very aromatic, are used in griping disorders of men and cattle. Hence we descended suddenly to the Great Rungeet, which we reached at its junction with the Kulhait: the path was very steep and slippery, owing to micaceous rocks, and led along the side of an enormous Mendong,[1] which ran down the hill for several hundred yards, and had a large chait at each end, with several smaller ones at intervals. Throughout its length were innumerable inscriptions of "Om Mani Padmi om," with well carved figures of Boodh in his many incarnations, besides Lamas, &c. At the lower end was a great flat area, on which are burnt the bodies of Sikkim people of consequence: the poorer people are buried, the richer burned, and their ashes scattered or interred, but not in graves proper, of which there are none. Nor are there any signs of Lepcha interment throughout Sikkim; though chaits are erected to the

[1] This remarkable structure, called the Kaysing Mendong, is 200 yards long, 10 feet high, and 6 or 8 feet broad: it is built of flat, slaty stones, and both faces are covered with inscribed slates, of which there are upwards of 700, and the inscriptions, chiefly "Om Mani," &c., are in both the Uchen and Lencha Ranja characters of Tibet. A tall stone, nine feet high, covered also with inscriptions, terminates it at the lower end.

memory of the departed, they have no necessary connection with the remains, and generally none at all. Corpses in Sikkim are never cut to pieces and thrown into lakes, or exposed on hills for kites and crows to devour, as is the case in Tibet.

We passed some curious masses of crumpled chlorite slate, presenting deep canals or furrows, along which a demon once drained all the water from the Pemiongchi spur, to the great annoyance of the villagers: the Lamas, however, on choosing this as a site for their temples, easily confounded the machinations of



PEMIONGCHI GOOMPA AND CHAITS.

the evil spirit, who, in the eyes of the simple Lepchas, was answerable for all the mischief.

I crossed the Great Rungeet at 1,840 feet above the sea, where its bed was twenty yards in width; a rude bridge, composed of two culms of bamboo and a handrail, conducted me to the other side, where we camped (on the east bank) in a thick tropical jungle. In the evening I walked down the banks of the river,

which flowed in a deep gorge, cumbered with enormous boulders of granite, clay-slate, and mica-slate; the rocks *in situ* were all of the latter description, highly inclined, and much dislocated. Some of the boulders were fully ten feet in diameter, permeated and altered very much by granite veins which had evidently been injected when molten, and had taken up angular masses of the chlorite, which remained, as it were, suspended in the veins.

It is not so easy to account for the present position of these blocks of granite, a rock not common at elevations below 10,000 feet. They have been transported from a considerable distance in the interior of the lofty valley to the north, and have descended not less than 8,000 feet, and travelled fully fifteen miles in a straight line, or perhaps forty along the river bed. It may be supposed that moraines have transported them to 8,000 feet (the lowest limit of apparent moraines), and the power of river water carried them further; if so, the rivers must have been of much greater volume formerly than they are now.

Our camp was on a gravel flat, like those of the Nepal valleys, about sixty feet above the river; its temperature was 52°, which felt cool when bathing.

From the river we proceeded west, following a steep and clayey ascent up the end of a very long spur, from the lofty mountain range called Mungbreu, dividing the Great Rungeet from the Teesta. We ascended by a narrow path, accomplishing 2,500 feet in an hour and a quarter, walking slowly but steadily, without resting; this I always found a heavy pull in a hot climate.

At about 4,000 feet above the sea, the spur became more open and flat, like those of the Kulhait valley, with alternate slopes and comparative flats: from this elevation the view north, south, and west was very fine. Below me flowed the river, and a few miles up it was the conical wooded hill of Tassiding, rising abruptly from a fork of the deep river gorge, crowned with its curious temples and mendongs, and bristling with chaits: on it is the oldest monastery in Sikkim, occupying a singularly picturesque and prominent position. North of this spur, and similar to it, lay that of Rāk-lang, with the temple and monastery of the same name, at about this elevation. In front, looking west across the Great Rungeet, were the monasteries of Changachelling and Pemiongchi, perched aloft; and south of these were the flat-topped spurs of the Kulhait valley, with their villages, and the great mendong which I had passed on the previous day, running like a white line down the spur. To the north, beyond Tassiding, were two other monasteries, Doobdee and Sunnook, both apparently placed on the lower

wooded flanks of Kinchinjunga; whilst close by was Dholing, the seventh religious establishment now in sight.

We halted at a good wooden house to refresh ourselves with Murwa beer, where I saw a woman with cancer in the face, an uncommon disease in this country. I here bought a little black puppy, to be my future companion in Sikkim: he was of a breed between the famous Tibet mastiff and the common Sikkim hunting dog, which is a variety of the sorry race called Pariah in the plains. Being only a few weeks old, he looked a mere bundle of black fur; and I carried him off, for he could not walk.

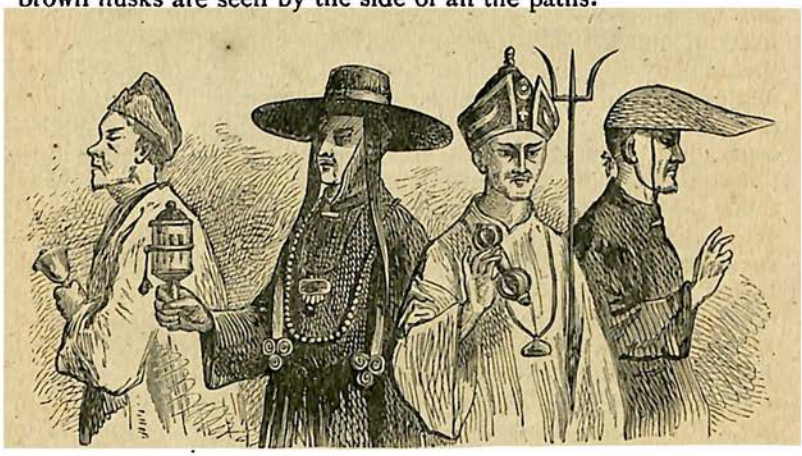
We camped at the village of Lingdam (alt. 5,550 feet), occupying a flat, and surrounded by extensive pools of water (for this country) containing *Acorus*, *Potamogeton*, and duckweed. Such ponds I have often met with on these terraces, and they are very remarkable, not being dammed in by any conspicuous barrier, but simply occupying depressions in the surface, from which, as I have repeatedly observed, the land dips rapidly to the valleys below.

This being the high-road from Tumloong or Sikkim Durbar (the capital, and Rajah's residence) to the numerous monasteries which I had seen, we passed many Lamas and monks on their way home from Tumloong, where they had gone to be present at the marriage of the Tupgain Lama, the eldest son of the Rajah. A dispensation having previously been procured from Lhassa, this marriage had been effected by the Lamas, in order to counteract the efforts of the Dewan, who sought to exercise an undue influence over the Rajah and his family. The Tupgain Lama having only spiritual authority, and being bound to celibacy, the temporal authority devolved on the second son, who was heir apparent of Sikkim; he, however, having died, an illegitimate son of the Rajah was favoured by the Dewan as heir apparent. The bride was brought from Tibet, and the marriage party were feasted for eighteen days at the Rajah's expense. All the Lamas whom I met were clad in red robes, with girdles, and were shaven, with bare feet and heads, or mitred; they wore rosaries of onyx, turquoise, quartz, lapis lazuli, coral, glass, amber, or wood, especially yellow berberry and sandal-wood: some had staves, and one a trident like an eel-fork, on a long staff, an emblem of the Hindoo Trinity, called Trisool Mahadeo, which represents Brahma, Siva, and Vishnu, in Hindoo; and Boodh, Dhurma, and Sunga, in Boodhist theology. All were on foot, indeed ponies are seldom used in this country; the Lamas, however, walked with becoming gravity and indifference to all around them.

The Kajee waited upon me in the evening, full of importance,

having just received a letter from his Rajah, which he wished to communicate to me in private; so I accompanied him to a house close by, where he was a guest, when the secret came out, that his highness was dreadfully alarmed at my coming with the two Ghorka Sepoys, whom I accordingly dismissed.

The house was of the usual Bhoteea form, of wood, well built on posts, one-storied, containing a single apartment hung round with bows, quivers, shields, baskets of rice, and cornucopias of Indian corn, the handsomest and most generous looking of all the Cerealia. The whole party were deep in a carouse on Murwa beer, and I saw the operation of making it. The millet-seed is moistened, and ferments for two days: sufficient for a day's allowance is then put into a vessel of wicker-work, lined with India-rubber to make it water-tight; and boiling water is poured on it with a ladle of gourd, from a huge iron cauldron that stands all day over the fire. The fluid, when quite fresh, tastes like negus of Cape sherry, rather sour. At this season the whole population are swilling, whether at home or travelling, and heaps of the red-brown husks are seen by the side of all the paths.



SIKKIM LAMAS WITH PRAYING CYLINDER AND DORJE; THE LATERAL FIGURES ARE MONKS OR GYLONGS.

CHAPTER XIII.

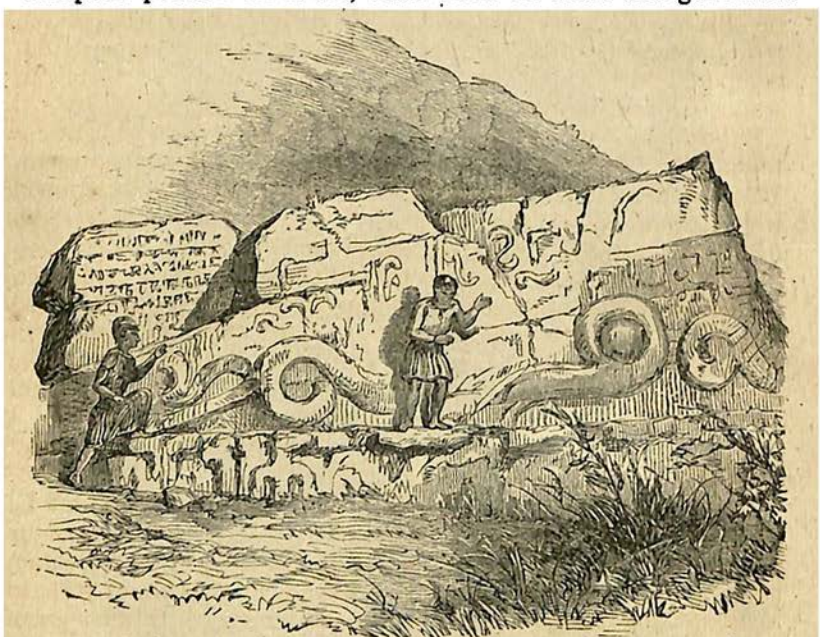
Raklang pass—Uses of nettles—Edible plants—Lepcha war—Do-mani stone—Neongong—Teesta valley—Pony, saddle, &c.—Meet Campbell—Vegetation and scenery—Presents—Visit of Dewan—Characters of Rajah and Dewan—Accounts of Tibet—Lhassa—Siling—Tricks of Dewan—Walk up Teesta—Audience of Rajah—Lamas—Kajees—Tchebu Lama, his character and position—Effects of interview—Heir-apparent—Dewan's house—Guitar—Weather—Fall of river—Tibet officers—Gigantic trees—Neongong lake—Mainom, ascent of—Vegetation—Camp on snow—Silver firs—View from top—Kinchin, &c.—Geology—Vapours—Sunset effect—Elevation—Temperature, &c.—Lamas of Neongong—Temples—Religious festival—Bamboo, flowering—Re-cross pass of Raklang—Numerous temples, villages, &c.—Domestic animals—Descent to Great Rungeet.

ON the following morning, after receiving the usual presents from the Lamas of Dholing, and from a large posse of women belonging to the village of Barphiung, close by, we ascended the Raklang pass, which crosses the range dividing the waters of the Teesta from those of the Great Rungeet. The Kajee still kept beside me, and proved a lively companion; seeing me continually plucking and noting plants, he gave me much local information about them. He told me the uses made of the fibres of the various nettles: some being twisted for bowstrings, others as thread for sewing and weaving; while many are eaten raw and in soups, especially the numerous little succulent species. The great yellow-flowered *Begonia* was abundant, and he cut its juicy stalks to make sauce (as we do apple-sauce) for some pork which he expected to get at Bhomsong; the taste is acid and very pleasant. The large succulent fern, called *Botrychium*,[1] grew here plentifully; it is boiled and eaten, both here and in New Zealand. Ferns are more commonly used for food than is supposed. In Calcutta the Hindoos boil young tops of a *Polypodium* with their shrimp curries; and both in Sikkim and Nepal the watery tubers of an *Aspidium* are abundantly eaten. So also the pulp of one tree-fern affords food, but only in times of scarcity, as does that of another species in New Zealand (*Cyathea medullaris*): the pith of all is composed of a coarse sago, that is to say, of cellular tissue with starch granules.

A thick forest of Darjeeling vegetation covers the summit,

[1] *Botrychium Virginicum*, Linn. This fern is eaten abundantly by the New Zealanders: its distribution is most remarkable, being found very rarely indeed in Europe, and in Norway only. It abounds in many parts of the Southern United States, the Andes of Mexico, &c., in the Himalaya mountains, Australia, and New Zealand.

which is only 6,800 feet above the sea: it is a saddle, connecting the lofty mountain of Mainom (alt. 11,000 feet) to the north, with Tendong (alt. 8,663 feet) to the south. Both these mountains are on a range which is continuous with Kinchinjunga, projecting from it down into the very heart of Sikkim. A considerable stand was made here by the Lepchas during the Nepal war in 1787; they defended the pass with their arrows for some hours, and then retired towards the Teesta, making a second stand lower down, at a place pointed out to me, where rocks on either side gave them



DO-MANI STONE

the same advantages. The Nepalese, however, advanced to the Teesta, and then retired with little loss.

Unfortunately a thick mist and heavy rain cut off all view of the Teesta valley, and the mountains of Chola to the eastward; which I much regretted.

Descending by a very steep, slippery path, we came to a fine mass of slaty gneiss, thirty feet long and thirteen feet high; not *in situ*, but lying on the mountain side; on its sloping face was carved in enormous characters, "Om Mani Padmi om;" of which letters the top strokes afford an uncertain footing to the enthusiast

who is willing to purchase a good metempsychosis by walking along the slope, with his heels or toes in their cavities. A small inscription in one corner is said to imply that this was the work of a pious monk of Raklang; and the stone is called "Do-mani," literally, "stone of prayer."

The rocks and peaks of Mainom are said to overhang the descent here with grandeur; but the continued rain hid everything but a curious shivered peak, apparently of chlorite schist, which was close by, and reflected a green colour; it is of course reported to be of turquoise, and inaccessible. Descending, the rocks became more micaceous, with broad seams of pipe-clay, originating in decomposed beds of felspathic gneiss: the natives used this to whitewash and mortar their temples.

I passed the monastery of Neongong, the monks of which were building a new temple; they came to bring me a large present. Below it is a pretty little lake, about 100 yards across, fringed with brushwood. We camped at the village of Nampok, 4,370 feet above the sea; all thoroughly sodden with rain.

During the night much snow had fallen at and above 9,000 feet, but the weather cleared on the following morning, and disclosed the top of Mainom, rising close above my camp, in a series of rugged shivered peaks, crested with pines, which looked like statues of snow: to all other quarters this mountain presents a very gently sloping outline. Up the Teesta valley there was a very pretty peep of snowy mountains, bearing north 35° east, of no great height.

I was met by a messenger from Dr. Campbell, who told me he was waiting breakfast; so I left my party, and, accompanied by the Kajee and Meepo, hurried down to the valley of the Rungoon (which flows east to the Teesta), through a fine forest of tropical trees; passing the villages of Broom [1] and Lingo, to the spur of that name; where I was met by a servant of the Sikkim Dewan's, with a pony for my use. I stared at the animal, and felt inclined to ask what he had to do here, where it was difficult enough to walk up and down slippery slopes, amongst boulders of rock, heavy forest and foaming torrents; but I was little aware of what these beasts could accomplish. The Tartar saddle was imported

[1] On the top of the ridge above Broom, a tall stone is erected by the side of the path, covered with private marks, indicating the height of various individuals who are accustomed to measure themselves thus; there was but one mark above 5 feet 7 inches, and that was 6 inches higher. It turned out to be Campbell's, who had passed a few days before, and was thus proved to top the natives of Sikkim by a long way.

from Tibet, and certainly a curiosity; once—but a long time ago —it must have been very handsome; it was high-peaked, covered with shagreen and silvered ornaments, wretchedly girthed, and with great stirrups attached to short leathers. The bridle and head-gear were much too complicated for description; there were good leather, raw hide, hair-rope, and scarlet worsted all brought into use; the bit was the ordinary Asiatic one, jointed, and with two rings. I mounted on one side, and at once rolled over, saddle and all, to the other; the pony standing quite still. I preferred walking; but Dr. Campbell had begged of me to use the pony, as the Dewan had procured and sent it at great trouble: I, however, had it led till I was close to Bhomsong, when I was hoisted into the saddle and balanced on it, with my toes in the stirrups and my knees up to my breast; twice, on the steep descent to the river, my saddle and I were thrown on the pony's neck; in these awkward emergencies I was assisted by a man on each side, who supported my weight on my elbows: they seemed well accustomed to easing mounted ponies down hill without giving the rider the trouble of dismounting. Thus I entered Dr. Campbell's camp at Bhomsong, to the pride and delight of my attendants; and received a hearty welcome from my old friend, who covered me with congratulations on the successful issue of a journey which, at this season, and under such difficulties and discouragements, he had hardly thought feasible.

Dr. Campbell's tent was pitched in an orange-grove, occupying a flat on the west bank of the Teesta, close to a small enclosure of pine-apples, with a pomegranate tree in the middle. The valley is very narrow, and the vegetation wholly tropical, consisting of two species of oak, several palms, rattan-canes, screw-pine (*Pandanus*), and tall grasses, all the natives of dense hot jungles. The river is a grand feature, broad, rocky, deep, swift, and broken by enormous boulders of rock; its waters were of a pale opal green, probably from the materials of the soft micaceous-rocks through which it flows.

A cane bridge crosses it,[1] but had been cut away (in feigned distrust of us), and the long canes were streaming from their attachments on either shore down the stream, and a triangular raft of bamboo was plying instead, drawn to and fro by means of a strong cane.

Soon after arriving I received a present from the Rajah, consisting of a brick of Tibet tea, eighty pounds of rancid yak butter, done up in yak-hair cloth, three loads of rice, and one of Murwa

[1] Whence the name of Bhomsong Samdong, the latter word meaning bridge.

for beer; rolls of bread,[1] fowls, eggs, dried plums, apricots, jujubes, currants, and Sultana raisins, the latter fruits purchased at Lhassa, but imported thither from western Tibet; also some trays of coarse milk-white crystallised salt, as dug in Tibet.

In the evening we were visited by the Dewan, the head and front of all our Sikkim difficulties, whose influence was paramount with the Rajah, owing to the age and infirmities of the latter, and his devotion to religion, which absorbed all his time and thoughts. The Dewan was a good-looking Tibetan, very robust, fair, muscular and well fleshed; he had a very broad Tartar face, quite free of hair; a small and beautifully formed mouth and chin, very broad cheekbones, and a low, contracted forehead: his manners were courteous and polite, but evidently affected, in assumption of better breeding than he could in reality lay claim to. The Rajah himself is a Tibetan of just respectable extraction, a native of the Sokpo province, north of Lhassa: his Dewan was related to one of his wives, and I believe a Lhassan by birth as well as extraction, having probably also Kashmir blood in him.[2] Though minister, he was neither financier nor politician, but a mere plunderer of Sikkim, introducing his relations, and those whom he calls so, into the best estates in the country, and trading in great and small wares, from a Tibet pony to a tobacco pipe, wholesale and retail. Neither he nor the Rajah are considered worthy of notice by the best Tibet families or priests, or by the Chinese commissioners settled in Lhassa and Jigatzi. The latter regard Sikkim as virtually English, and are contented with knowing that its ruler has no army, and with believing that its protectors, the English, could not march an army across the Himalaya, if they would.

The Dewan, trading in wares which England could supply better and cheaper, naturally regarded us with repugnance, and did everything in his power to thwart Dr. Campbell's attempts to open a friendly communication between the Sikkim and English governments. The Rajah owed everything to us, and was, I believe, really grateful; but he was a mere cipher in the hands of his minister. The priests again, while rejoicing in our proximity, were apathetic, and dreaded the more active Dewan; and the people had long given evidence of their confidence in the

[1] These rolls, or rather sticks of bread, are made in Tibet, of fine wheaten flour, and keep for a long time: they are sweet and good, but very dirtily prepared.

[2] The Tibetans court promiscuous intercourse between their families and the Kashmir merchants who traverse their country.

English. Under these circumstances it was in the hope of gaining the Rajah's own ear, and representing to him the advantages of promoting an intercourse with us, and the danger of continuing to violate the terms of our treaty, that Dr. Campbell had been authorised by Government to seek an interview with his Highness. At present our relations were singularly infelicitous. There was no agent on the Sikkim Rajah's part to conduct business at Darjeeling, and the Dewan insisted on sending a creature of his own, who had before been dismissed for insolence. Malefactors who escaped into Sikkim were protected, and our police interrupted in the discharge of their duties; slavery was practised; and government communications were detained for weeks and months under false pretences.

In his interviews with us the Dewan appeared to advantage: he was fond of horses and shooting, and prided himself on his hospitality. We gained much information from many conversations with him, during which politics were never touched upon. Our queries naturally referred to Tibet and its geography, especially its great feature the Yarou Tsampoo river; this he assured us was the Burrampooter of Assam, and that no one doubted it in Tibet. Lhassa he described as a city in the bottom of a flat-floored valley, surrounded by lofty snowy mountains: neither grapes, tea, silk, or cotton are produced near it, but in the Tartchi province of Tibet, one month's journey east of Lhassa, rice, and a coarse kind of tea are both grown. Two months' journey north-east of Lhassa is Siling, the well-known great commercial entrepôt[1] in west China; and there coarse silk is produced. All Tibet he described as mountainous, and an inconceivably poor country: there are no plains, save flats in the bottoms of the valleys, and the paths lead over lofty mountains. Sometimes, when the inhabitants are obliged from famine to change their habitations in winter, the old and feeble are frozen to death, standing and resting their chins on their staves; remaining as pillars of ice, to fall only when the thaw of the ensuing spring commences.

We remained several days at Bhomsong, awaiting an interview with the Rajah, whose movements the Dewan kept shrouded in mystery. On Dr. Campbell's arrival at this river a week before, he found messengers waiting to inform him that the Rajah would meet him here; this being half way between Darjeeling and Tumloong. Thenceforward every subterfuge was

[1] The entrepôt is now removed to Tang-Keou-Eul.—See Huc and Gabet.

resorted to by the Dewan to frustrate the meeting; and even after the arrival of the Rajah on the east bank, the Dewan communicated with Dr. Campbell by shooting across the river arrows to which were attached letters, containing every possible argument to induce him to return to Darjeeling; such as that the Rajah was sick at Tumloong, that he was gone to Tibet, that he had a religious fast and rites to perform, &c., &c.

One day we walked up the Teesta to the Rumphiup river, a torrent from Mainom mountain to the west; the path led amongst thick jungle of *Wallichia* palm, prickly rattan canes, and the *Pandanus*, or screw-pine, called "Borr," which has a straight, often forked, palm-like trunk, and an immense crown of grassy saw-edged leaves four feet long: it bears clusters of uneatable fruit as large as a man's fist, and their similarity to the pine-apple has suggested the name of "Borr" for the latter fruit also, which has for many years been cultivated in Sikkim, and yields indifferent produce. Beautiful pink balsams covered the ground, but at this season few other showy plants were in flower: the rocks were chlorite, very soft and silvery, and so curiously crumpled and contorted as to appear as though formed of scales of mica crushed together, and confusedly arranged in layers: the strike was north-west, and dip north-east from 60° to 70°.

Messengers from the Dewan overtook us at the river to announce that the Rajah was prepared and waiting to give us a reception; so we returned, and I borrowed a coat from Dr. Campbell instead of my tattered shooting-jacket; and we crossed the river on the bamboo-raft. As it is the custom on these occasions to exchange presents, I was officially supplied with some red cloth and beads: these, as well as Dr. Campbell's present, should only have been delivered during or after the audience; but our wily friend the Dewan here played us a very shabby trick; for he managed that our presents should be stealthily brought in before our appearance, thus giving to the by-standers the impression of our being tributaries to his Highness!

The audience chamber was a mere roofed shed of neat bamboo wattle, about twenty feet long; two Bhoteeas in scarlet jackets, and with bows in their hands, stood on each side of the door, and our own chairs were carried before us for our accommodation. Within was a square wicker throne, six feet high, covered with purple silk, brocaded with dragons in white and gold, and overhung by a canopy of tattered blue silk, with which material part

of the walls also was covered. An oblong box (containing papers) with gilded dragons on it, was placed on the stage or throne, and behind it was perched cross-legged, an odd, black, insignificant looking old man, with twinkling upturned eyes: he was swathed in yellow silk, and wore on his head a pink silk hat with a flat broad crown, from all sides of which hung floss silk. This was the Rajah, a genuine Tibetan, about seventy years old. On some steps close by, and ranged down the apartment, were his relations, all in brocaded silk robes reaching from the throat to the ground, and girded about the waist; and wearing caps similar to that of the Rajah. Kajees, counsellors, and shaven mitred Lamas were there, to the number of twenty, all planted with their backs to the wall, mute and motionless as statues. A few spectators were huddled together at the lower end of the room, and a monk waved about an incense pot containing burning juniper and other odoriferous plants. Altogether the scene was solemn and impressive: as Campbell well expressed it, the genius of Lamaism reigned supreme.

We saluted, but received no complimentary return; our chairs were then placed, and we seated ourselves, when the Dewan came in, clad in a superb purple silk robe, worked with circular gold figures, and formally presented us. The Dewan then stood; and as the Rajah did not understand Hindoostanee, our conversation was carried on through the medium of a little bare-headed rosy-cheeked Lama, named "Tchebu," clad in a scarlet gown, who acted as interpreter. The conversation was short and constrained: Tchebu was known as a devoted servant of the Rajah and of the heir apparent; and in common with all the Lamas he hates the Dewan, and desires a friendly intercourse between Sikkim and Darjeeling. He is, further, the only servant of the Rajah capable of conversing both in Hindoo and Tibetan, and the uneasy distrustful look of the Dewan, who understands the latter language only, was very evident. He was as anxious to hurry over the interview, as Dr. Campbell and Tchebu were to protract it; it was clear, therefore, that nothing satisfactory could be done under such auspices.

As a signal for departure white silk scarves were thrown over our shoulders, according to the established custom in Tibet, Sikkim, and Bhotan; and presents were made to us of China silks, bricks of tea, woollen cloths, yaks, ponies, and salt, with worked silk purses and fans for Mrs. Campbell; after which we left. The whole scene was novel and very curious. We had had no previous idea of the extreme poverty of the Rajah, of his

utter ignorance of the usages of Oriental life, and of his not having any one near to instruct him. The neglect of our salutation, and the conversion of our presents into tribute, did not arise from any ill-will: it was owing to the craft of the Dewan in taking advantage of the Rajah's ignorance of his own position and of good manners. Miserably poor, without any retinue, taking no interest in what passes in his own kingdom, subsisting on the plainest and coarsest food, passing his time in effectually abstracting his mind from the consideration of earthly things, and wrapt in contemplation, the Sikkim Rajah has arrived at great sanctity, and is all but prepared for that absorption into the essence of Boodh, which is the end and aim of all good Boodhists. The mute conduct of his Court, who looked like attendants at an inquisition, and the profound veneration expressed in every word and gesture of those who did move and speak, recalled a Pekin reception. His attendants treated him as a being of a very different nature from themselves; and well might they do so, since they believe that he will never die, but retire from the world only to re-appear under some equally sainted form.

Though productive of no immediate good, our interview had a very favourable effect on the Lamas and people, who had long wished it; and the congratulations we received thereon during the remainder of our stay in Sikkim were many and sincere. The Lamas we found universally in high spirits; they having just effected the marriage of the heir apparent, himself a Lama, said to possess much ability and prudence, and hence being very obnoxious to the Dewan, who vehemently opposed the marriage. As, however, the minister had established his influence over the youngest, and estranged the Rajah from his eldest son, and was moreover in a fair way for ruling Sikkim himself, the Church rose in a body, procured a dispensation from Lhassa for the marriage of a priest, and thus hoped to undermine the influence of the violent and greedy stranger.

In the evening, we paid a farewell visit to the Dewan, whom we found in a bamboo wicker-work hut, neatly hung with bows, arrows, and round Lepcha shields of cane, each with a scarlet tuft of yak-hair in the middle; there were also muskets, Tibetan arms, and much horse gear; and at one end was a little altar, with cups, bells, pastiles, and images. He was robed in a fawn-coloured silk gown, lined with the softest of wool, that taken from unborn lambs. Like most Tibetans, he extracts all his beard with tweezers; an operation he civilly recommended to me,

accompanying the advice with the present of a neat pair of steel forceps. He aspires to be considered a man of taste, and plays the Tibetan guitar, on which he performed some airs for our amusement: the instrument is round-bodied and long-armed, with six strings placed in pairs, and probably comes from Kashmir: the Tibetan airs were simple and quite pretty, with the time well marked.

During our stay at Bhomsong, the weather was cool, considering the low elevation (1,500 feet), and very steady; the mean temperature was 52¼°, the maximum 71¼°, the minimum 42¾°. The sun set behind the lofty mountains at 3 P.M., and in the morning a thick, wet, white, dripping fog settled in the bottom of the valley, and extended to 800 or 1,000 feet above the river-bed; this was probably caused by the descent of cold currents into the humid gorge: it was dissipated soon after sunrise, but formed again at sunset for a few minutes, giving place to clear starlight nights.

A thermometer sunk two feet seven inches, stood at 64°. The temperature of the water was pretty constant at 51°: from here to the plains of India the river has a nearly uniform fall of 1,000 feet in sixty-nine miles, or sixteen feet to a mile: were its course straight for the same distance, the fall would be 1,000 feet in forty miles, or twenty-five feet to a mile.

Dr. Campbell's object being accomplished, he was anxious to make the best use of the few days that remained before his return to Darjeeling, and we therefore arranged to ascend Mainom, and visit the principal convents in Sikkim together, after which he was to return south, whilst I should proceed north to explore the south flank of Kinchinjunga. For the first day our route was that by which I had arrived. We left on Christmas-day, accompanied by two of the Rajah's, or rather Dewan's officers, of the ranks of Dingpun and Soupan, answering to those of captain and lieutenant; the titles were, however, nominal, the Rajah having no soldiers, and these men being profoundly ignorant of the mysteries of war or drill. They were splendid specimens of Sikkim Bhoteeas (*i.e.*, Tibetans, born in Sikkim, sometimes called Arrhats), tall, powerful, and well built, but insolent and bullying: the Dingpun wore the Lepcha knife, ornamented with turquoises, together with Chinese chopsticks. Near Bhomsong, Campbell pointed out a hot bath to me, which he had seen employed: it consisted of a hollowed prostrate tree trunk, the water in which was heated by throwing in hot stones with bamboo tongs. The temperature is thus raised to 114°, to which

the patient submits at repeated intervals for several days, never leaving till wholly exhausted. These baths are called "Sa-choo," literally "hot-water," in Tibetan.

We stopped to measure some splendid trees in the valley, and found the trunk of one to be forty-five feet round the buttresses, and thirty feet above them, a large size for the Himalaya: they were a species of *Terminalia* (*Pentaptera*), and called by the Lepchas "Sillok-Kun," "Kun" meaning tree.

We slept at Nampok, and the following morning commenced the ascent. On the way we passed the temple and lake of Neongong; the latter is about 400 yards round, and has no outlet. It contained two English plants, the common duckweed (*Lemna minor*), and *Potamogeton natans:* some coots were swimming in it, and having flushed a woodcock, I sent for my gun, but the Lamas implored us not to shoot, it being contrary to their creed to take life wantonly.

We left a great part of our baggage at Neongong, as we intended to return there; and took up with us bedding, food, &c, for two days. A path hence up the mountain is frequented once a year by the Lamas, who make a pilgrimage to the top for worship. The ascent was very gradual for 4,000 feet. We met with snow at the level of Darjeeling (7,000 feet), indicating a colder climate than at that station, where none had fallen; the vegetation was, however, similar, but not so rich, and at 8,000 feet trees common also to the top of Sinchul appeared, with *Rhododendron Hodgsoni*, and the beautiful little winter-flowering primrose, *Primula petiolaris*, whose stemless flowers spread like broad purple stars on the deep green foliage. Above, the path runs along the ridge of the precipices facing the south-east, and here we caught a glimpse of the great valley of the Ryott, beyond the Teesta, with Tumloong, the Rajah's residence, on its north flank, and the superb snowy peak of Chola at its head.

One of our coolies, loaded with crockery and various indispensables, had here a severe fall, and was much bruised; he however recovered himself, but not our goods.

The rocks were all of chlorite slate, which is not usual at this elevation; the strike was north-west, and dip north-east. At 9,000 feet various shrubby rhododendrons prevailed, with mountain-ash, birch, and dwarf-bamboo; also *R. Falconeri*, which grew from forty to fifty feet high. The snow was deep and troublesome, so we encamped at 9,800 feet, or 800 feet below the top, in a wood of *Pyrus*, *Magnolia*, *Rhododendron*, and bamboo. As the ground was deeply covered with snow, we laid our beds on a thick layer

of rhododendron twigs, bamboo, and masses of a pendent moss.

We passed a very cold night, chiefly owing to damp, the temperature falling to 24.° On the following morning we scrambled through the snow, reaching the summit after an hour's very laborious ascent, and took up our quarters in a large wooden barn-like temple (*goompa*), built on a stone platform. The summit was very broad, but the depth of the snow prevented our exploring much, and the silver firs (*Abies Webbiana*) were so tall, that no view could be obtained, except from the temple. The great peak of Kinchinjunga is in part hidden by those of Pundim and Nursing, but the panorama of snowy mountains is very grand indeed. The effect is quite deceptive; the mountains assuming the appearance of a continued chain, the distant snowy peaks being seemingly at little further distance than the nearer ones. The whole range (about twenty-two miles nearer than at Darjeeling) appeared to rise uniformly and steeply out of black pine forests, which were succeeded by the russet-brown of the rhododendron shrubs, and that again by tremendous precipices and gulleys, into which descended mighty glaciers and perpetual snows. This excessive steepness is however only apparent, being due to foreshortening.

The upper 10,000 feet of Kinchin, and the tops of Pundim, Kubra, and Junnoo, are evidently of granite, and are rounded in outline: the lower peaks again, as those of Nursing, &c., present rugged pinnacles of black and red stratified rocks, in many cases resting on white granite, to which they present a remarkable contrast. The general appearance was as if Kinchin and the whole mass of mountains clustered around it, had been upheaved by white granite; which still forms the loftiest summits, and has raised the black stratified rocks in some places to 20,000 feet in numerous peaks and ridges. One range presented on every summit a cap of black stratified rocks of uniform inclination and dip, striking north-west, with precipitous faces to the south-west: this was clear to the naked eye, and more evident with the telescope, the range in question being only fifteen miles distant, running between Pundim and Nursing. The fact of the granite forming the greatest elevation must not be hastily attributed to that igneous rock having burst through the stratified, and been protruded beyond the latter: it is much more probable that the upheaval of the granite took place at a vast depth, and beneath an enormous pressure of stratified rocks and perhaps of the ocean; since which period the elevation of the whole mountain

chain, and the denudation of the stratified rocks, has been slowly proceeding.

To what extent denudation has thus lowered the peaks we dare scarcely form a conjecture; but considering the number and variety of the beds which in some places overlie the gneiss and granite, we may reasonably conclude that many thousand feet have been removed.

It is further assumable that the stratified rocks originally took the forms of great domes, or arches. The prevailing north-west strike throughout the Himalaya vaguely indicates a general primary arrangement of the curves into waves, whose crests run north-west and south-east; an arrangement which no minor or posterior forces have wholly disturbed, though they have produced endless dislocations, and especially a want of uniformity in the amount and direction of the dip. Whether the loftiest waves were the result of one great convulsion, or of a long-continued succession of small ones, the effect would be the same, namely, that the strata over those points at which the granite penetrated the highest, would be the most dislocated, and the most exposed to wear during denudation.

We enjoyed the view of this superb scenery till noon, when the clouds which had obscured Darjeeling since morning were borne towards us by the southerly wind, rapidly closing in the landscape on all sides. At sunset they again broke, retreating from the northward, and rising from Sinchul and Darjeeling last of all, whilst a line of vapour, thrown by perspective into one narrow band, seemed to belt the Singalelah range with a white girdle, darkened to black where it crossed the snowy mountains; and it was difficult to believe that this belt did not really hang upon the ranges from twenty to thirty miles off, against which it was projected; or that its true position was comparatively close to the mountain on which we were standing, and was due to condensation around its cool, broad, flat summit.

As usual from such elevations, sunset produced many beautiful effects. The zenith was a deep blue, darkening opposite the setting sun, and paling over it into a peach colour, and that again near the horizon passing into a glowing orange-red, crossed by coppery streaks of cirrhus. Broad beams of pale light shot from the sun to the meridian, crossing the moon and the planet Venus. Far south, through gaps in the mountains, the position of the plains of India, 10,000 feet below us, was indicated by a deep leaden haze, fading upwards in gradually paler bands (of which I counted fifteen) to the clear yellow of the sunset sky. As dark-

ness came on, the mists collected around the top of Mainom, accumulating on the windward side, and thrown off in ragged masses from the opposite.

The second night we passed here was fine, and not very cold (the mean temperature being 27°), and we kept ourselves quite warm by pine-wood fires. On the following morning the sun tinged the sky of a lurid yellow-red: to the south-west, over the plains, the belts of leaden vapour were fewer (twelve being distinguishable) and much lower than on the previous evening, appearing as if depressed on the visible horizon. Heavy masses of clouds nestled into all the valleys, and filled up the larger ones, the mountain tops rising above them like islands.

The height of our position I calculated to be 10,613 feet. Colonel Waugh had determined that of the summit by trigonometry to be 10,702 feet, which probably includes the trees which cover it, or some rocky peaks on the broad and comparatively level surface.

The mean temperature of the twenty-four hours was 32° 7 ($\frac{\text{max. } 41°\,5}{\text{min. } 27°\,2}$), mean dew-point 29·7, and saturation 0·82. The mercury suddenly fell below the freezing point at sunset: and from early morning the radiation was so powerful, that a thermometer exposed on snow sank to 21° 2, and stood at 25° 5, at 10 A.M. The black bulb thermometer rose to 132°, at 9 A.M. on the 27th, or 94° 2 above the temperature of the air in the shade. I did not then observe that of radiation from snow; but if, as we may assume, it was not less than on the following morning (21° 2), we shall have a difference of 148° 6 Fahr., in contiguous spots; the one exposed to the full effects of the sun, the other to that of radiation through a rarefied medium to a cloudless sky. On the 28th the black bulb thermometer, freely suspended over the snow and exposed to the sun, rose to 108°, or 78° above that of the air in the shade (32°); the radiating surface of the same snow in the shade being 21° 2, or 86° 8 colder.

Having taken a complete set of angles and panoramic sketches from the top of Mainom, with seventeen hourly observations, and collected much information from our guides, we returned on the 28th to our tents pitched by the temples at Neongong; descending 7,000 feet, a very severe shake along Lepcha paths. In the evening the Lamas visited us, with presents of rice, fowls, eggs, &c., and begged subscriptions for their temple which was then building, reminding Dr. Campbell that he and the Governor-General had an ample share of their prayers, and benefited in proportion. As for me, they said, I was bound to give alms, as I

surely needed praying for, seeing how I exposed myself; besides my having been the first Englishman who had visited the snows of Kinchinjunga, the holiest spot in Sikkim.

On the following morning we visited the unfinished temple. The outer walls were of slabs of stone neatly chiselled, but badly mortared with felspathic clay and pounded slate, instead of lime; the partition walls were of clay, shaped in moulds of wood; parallel planks, four feet asunder, being placed in the intended position of the walls, and left open above, the composition was placed in these boxes, a little at a time, and rammed down by the feet of many men, who walked round and round the narrow enclosure, singing, and also using rammers of heavy wood. The outer work was of good hard timber, of Magnolia ("Pendre-kun" of the Lepchas) and oak, ("Sokka"). The common "Ban," or Lepcha knife, supplied the place of axe, saw, adze, and plane; and the graving work was executed with small tools, chiefly on Toon (*Cedrela*), a very soft wood (the "Simal-kun" of the Lepchas).

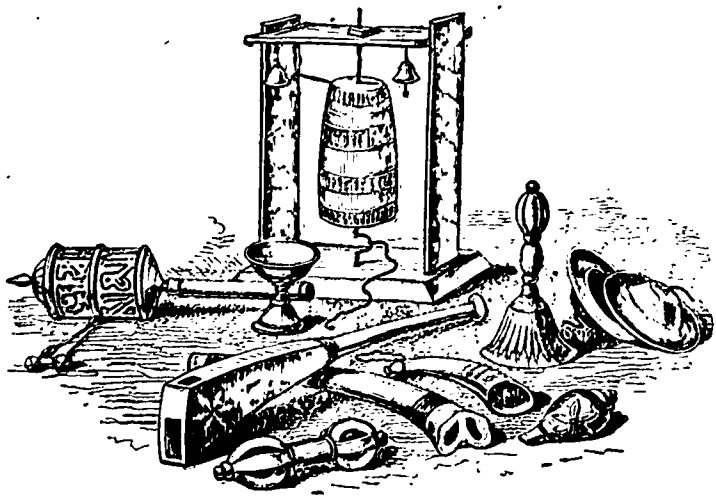
This being a festival day, when the natives were bringing offerings to the altar, we also visited the old temple, a small wooden building Besides more substantial offerings, there were little cones of rice with a round wafer of butter at the top, ranged on the altar in order.[1] Six Lamas were at prayer, psalms, and contemplation, sitting cross-legged on two small benches that ran down the building: one was reading, with his hand and fore-finger elevated, whilst the others listened; anon they all sang hymns, repeated sacred or silly precepts to the bystanders, or joined in a chorus with boys, who struck brass cymbals, and blew straight copper trumpets six feet long, and conch-shells mounted with broad silver wings, elegantly carved with dragons. There were besides manis, or praying-cylinders, drums, gongs, books, and trumpets made of human thigh-bones, plain or mounted in silver.

Throughout Sikkim, we were roused each morning at daybreak by this wild music, the convents being so numerous that we were

[1] The worshippers, on entering, walk straight up to the altar, and before, or after, having deposited their gifts, they lift both hands to the forehead, fall on their knees, and touch the ground three times with both head and hands, raising the body a little between each prostration. They then advance to the head Lama, kotow similarly to him, and he blesses them, laying both hands on their heads and repeating a short formula. Sometimes the dorje is used in blessing, as the cross is in Europe, and when a mass of people request a benediction, the Lama pronounces it from the door of the temple with outstretched arms, the people all being prostrate, with their foreheads touching the ground.

always within hearing of it. To me it was always deeply impressive, sounding so foreign, and awakening me so effectually to the strangeness of the wild land in which I was wandering, and of the many new and striking objects it contained. After sleep, too, during which the mind has either been at rest, or carried away to more familiar subjects, the feelings of loneliness and sometimes even of despondency, conjured up by this solemn music, were often almost oppressive.

Ascending from Neongong, we reached that pass from the Teesta to the Great Rungeet, which I had crossed on the 22nd; and this time we had a splendid view, down both the valleys, of



IMPLEMENTS USED IN BOODHIST TEMPLES.

Praying cylinder in stand (see p. 119, footnote); another to be carried in the hand; cymbals; bell: brass cup; three trumpets; conch; dorje.

the rivers, and the many spurs from the ridge communicating between Tendong and Mainom, with many scattered villages and patches of cultivation. Near the top I found a plant of "Praong," (a small bamboo), in full seed; this sends up many flowering branches from the root, and but few leaf-bearing ones; and after maturing its seed, and giving off suckers from the root, the parent plant dies. The fruit is a dark, long grain, like rice; it is boiled and made into cakes, or into beer, like Murwa.

Looking west from the summit, no fewer than ten monastic establishments with their temples, villages and cultivation, were at once visible, in the valley of the Great Rungeet, and in those of

its tributaries; namely, Changachelling, Raklang, Dholi, Molli, Catsuperri, Dhoobdi, Sunnook, Powhungri, Pemiongchi and Tassiding, all of considerable size, and more or less remarkable in their sites, being perched on spurs or peaks at elevations varying from 3,000 to 7,000 feet, and commanding splendid prospects.

We encamped at Lingcham, where I had halted on the 21st, and the weather being fine, I took bearings of all the convents and mountains around. There is much cultivation here, and many comparatively rich villages, all occupying flat-shouldered spurs from Mainom. The houses are large, and the yards are full of animals familiar to the eye but not to the ear. The cows of Sikkim, though generally resembling the English in stature, form, and colour, have humps, and grunt rather than low; and the cocks wake the morning with a prolonged howling screech, instead of the shrill crow of chanticleer.

Hence we descended north-west to the Great Rungeet, opposite Tassiding; which is one of the oldest monastic establishments in Sikkim, and one we were very anxious to visit. The descent lay through a forest of tropical trees, where small palms, vines, peppers, *Pandanus*, wild plantain, and *Pothos*, were interlaced in an impenetrable jungle, and air-plants clothed the trees.

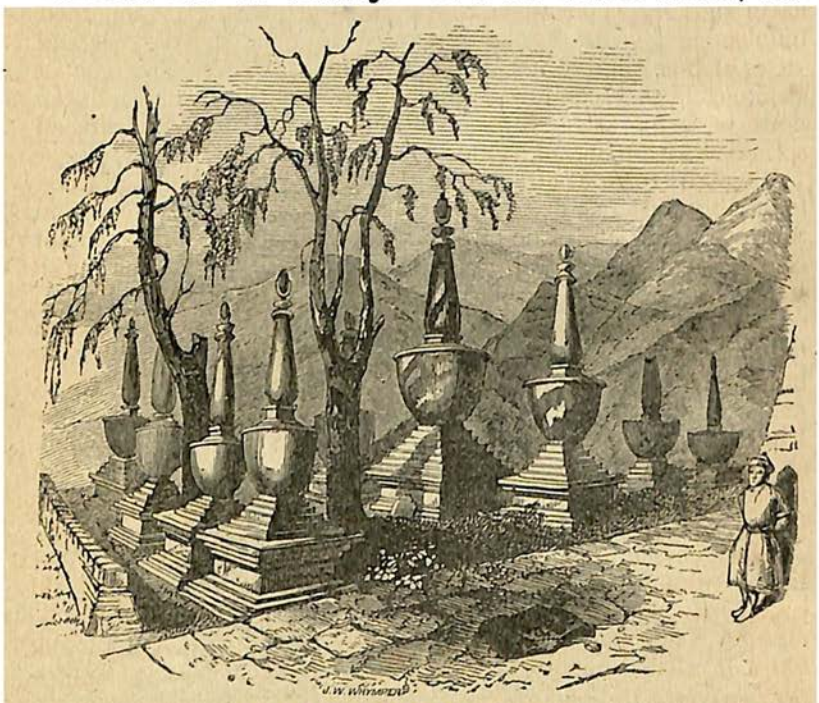
CHAPTER XIV.

Tassiding, view of and from—Funereal cypress—Camp at Sunnook—Hot vapours—Lama's house—Temples, decorations, altars, idols, general effect—Chaits—Date of erection—Plundered by Ghorkas—Cross Ratong—Ascend to Pemiongchi—Relation of river-beds to strike of rocks—Slopes of ravines—Pemiongchi, view of—Vegetation—Elevation—Temple, decorations, &c.—Former capital of Sikkim—History of Sikkim—Nightingales—Campbell departs—Tchonpong—Edgeworthia—Cross Rungbee and Ratong—Hoar-frost on plantains—Yoksun—Walnuts—View—Funereal cypresses—Doobdi—Gigantic cypresses—Temples—Snow-fall—Sikkim, &c.—Toys.

TASSIDING hill is the steep conical termination of a long spur from a pine-clad shoulder of Kinchinjunga, called Powhungri: it divides the Great Rungeet from its main feeder, the Ratong, which rises from the south face of Kinchin. We crossed the former by a bridge formed of two bamboo stems, slung by canes from two parallel arches of stout branches lashed together.

The ascent for 2,800 feet was up a very steep, dry, zigzag path, amongst mica-slate rocks (strike north-east), on which grew many

tropical plants, especially the "Tukla" (*Rottlera tinctoria*), a plant which yields a brown dye. The top was a flat, curving north-west and south-east, covered with temples, chaits, and mendongs of the most picturesque forms and in elegant groups, and fringed with brushwood, wild plantains, small palms, and apple-trees. Here I saw for the first time the funereal cypress, of which some very old trees spread their weeping limbs and pensile branchlets over the buildings.[1] It is not wild in Sikkim, but



GROUP OF CHAITS AT TASSIDING.

imported there and into Bhotan from Tibet: it does not thrive well above 6,000 feet elevation. It is called "Tchenden" by the Lepchas, Bhoteeas, and Tibetans, and its fragrant red wood is burnt in the temples.

The Lamas met us on the top of the hill, bringing a noble

[1] I was not then aware of this tree having been introduced into England by the intrepid Mr. Fortune from China; and as I was unable to procure seeds, which are said not to ripen in Sikkim, it was a great and unexpected pleasure, on my return home, to find it alive and flourishing at Kew. It has proved too tender for out-door cultivation in England.

present of fowls, vegetables and oranges, the latter most acceptable after our long and hot march. The site is admirably chosen, in the very heart of Sikkim, commanding a fine view, and having a considerable river on either side, with the power of retreating behind to the convents of Sunnook and Powhungri, which are higher up on the same spur, and surrounded by forest enough to conceal an army. Considering the turbulent and warlike character of their neighbours, it is not wonderful that the monks should have chosen commanding spots, and good shelter for their indolent lives: for the same reason these monasteries secured views of one another: thus from Tassiding the great temple of Pemiongchi was seen towering 3,000 feet over head, whilst to the north-west, up the course of the river, the hill-sides seemed sprinkled with monasteries.

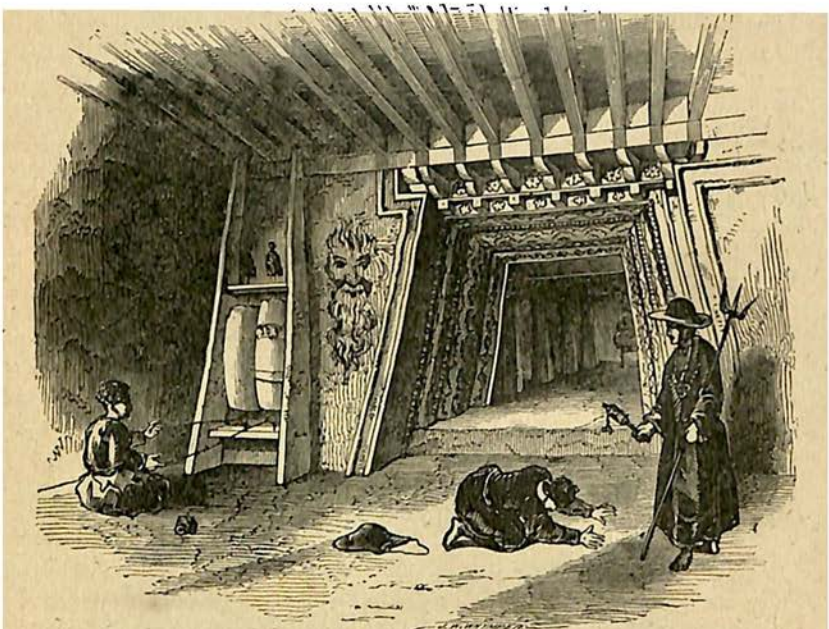
We camped on a saddle near the village of Sunnook, at 4,000 feeet above the sea; and on the last day of the year we visited this most interesting monastic establishment: ascending from our camp along the ridge by a narrow path, cut here and there into steps, and passing many rocks covered with inscriptions, broken walls of mendongs, and other remains of the *via sacra* between the village and temple. At one spot we found a fissure emitting hot vapour of the temperature of 65° 5, that of the air being about 50°. It was simply a hole amongst the rocks; and near the Rungeet a similar one is said to occur, whose temperature fluctuates considerably with the season. It is very remarkable that such an isolated spring should exist on the top of a sharp ridge, 2,800 feet above the bottom of this deep valley.

The general arrangement on the summit was, first the Lamas' houses with small gardens, then three large temples raised on rudely paved platforms, and beyond these, a square walled enclosure facing the south, full of chaits and mendongs, looking like a crowded cemetery, and planted with funereal cypress (*Cupressus funebris*).

The house of the principal Lama was an oblong square, the lower story of stone, and the upper of wood: we ascended a latter to the upper room, which was 24 feet by 8 wattled all round, with prettily latticed windows opening upon a bamboo balcony used for drying grain, under the eaves of the broad thatched roof. The ceiling (of neat bamboo work) was hung with glorious bunches of maize, yellow, red, and brown; an altar and closed wicker cage at one end of the room held the Penates, and a few implements of worship. Chinese carpets were laid on the floor for us, and the cans of Murwa brought round.

The Lama, though one of the red sect, was dressed in a yellow flowered silk robe, but his mitre was red: he gave us much information relative to the introduction of Boodhism into Sikkim.

The three temples stand about fifty yards apart, but are not parallel to one another, although their general direction is east and west.[1] Each is oblong, and narrowed upwards, with the door at one end; the middle (and smallest) faces the west, the others the east: the doorways are all broad, low and deep, pro-

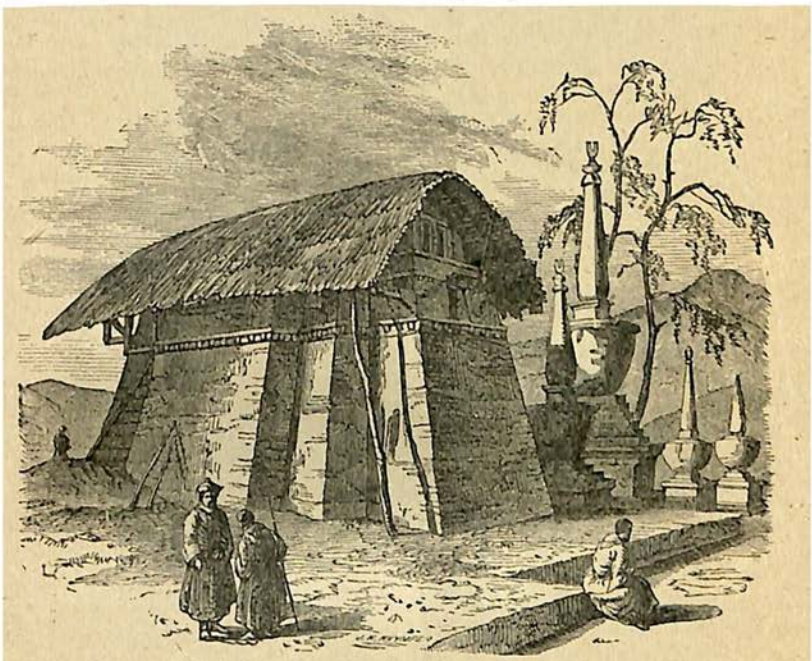


DOORWAY.

tected by a projecting carved portico. The walls are immensely thick, of well-masoned slaty stones; the outer surface of each slopes upwards and inwards, the inner is perpendicular. The roofs are low and thickly thatched, and project from eight to ten feet all round, to keep off the rain, being sometimes supported by long poles. There is a very low upper story, inhabited by the

[1] Timkowski, in his travels through Mongolia (i. p. 193), says, "According to the rules of Tibetan architecture, temples should face the south:" this is certainly not the rule in Sikkim, nor, so far as I could learn, in Tibet either.

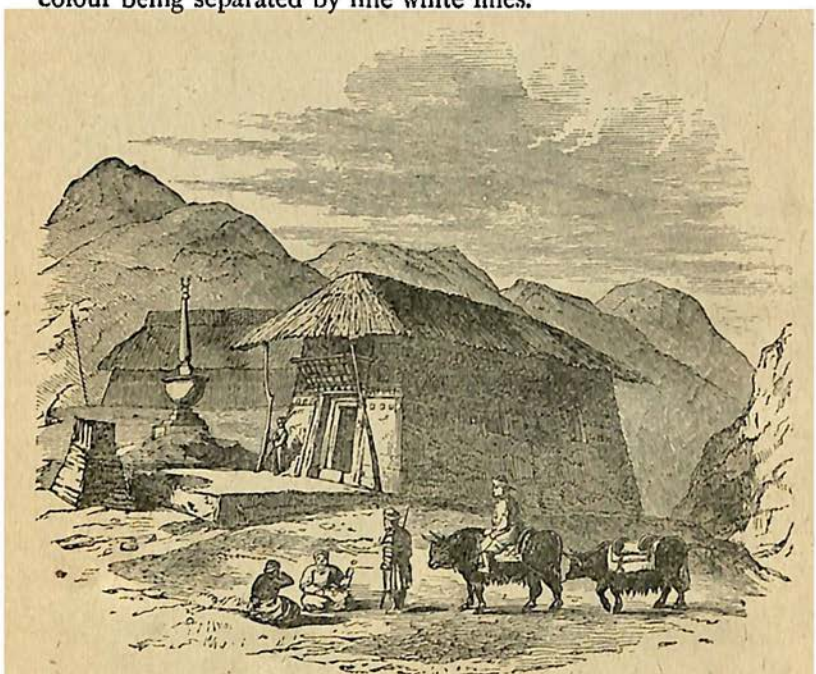
attendant monks and servants, accessible by a ladder at one end of the building. The main body of the temple is one large apartment, entered through a small tranverse vestibule, the breadth of the temple, in which are tall cylindrical praying-machines. The carving round the doors is very beautiful, and they are gaudily painted and gilded. The northern temple is quite plain: the middle one is simply painted red, and encircled with a row of black heads, with goggle eyes and numerous teeth, on a white ground; it is said to have been originally dedicated to the evil



SOUTHERN TEMPLE.

spirits of the Lepcha creed. The southern, which contains the library, is the largest and best, and is of an irregular square shape. The inside walls and floors are plastered with clay, and painted with allegorical representations of Boodh, &c. From the vestibule the principal apartment is entered by broad folding-doors, studded with circular copper bosses, and turning on iron hinges. It is lighted by latticed windows, sometimes protected outside by a bamboo screen. Owing to the great thickness of the walls (three to four feet), a very feeble light is admitted. In the principal

temple, called "Dugang," six hexagonal wooden columns, narrowed above, with peculiar broad transverse capitals, exquisitely gilded and painted, support the cross-beams of the roof, which are likewise beautifully ornamented. Sometimes a curly-maned gilt lion is placed over a column, and it is always furnished with a black bushy tail: squares, diamonds, dragons, and groups of flowers, vermilion, green, gold, azure, and white, are dispersed with great artistic taste over all the beams; the heavier masses of colour being separated by fine white lines.

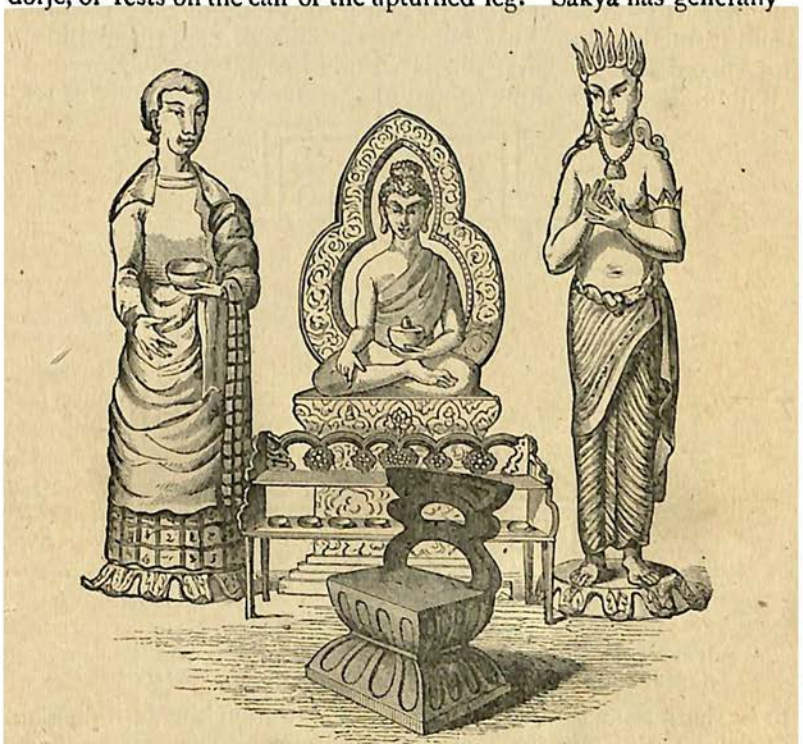


MIDDLE TEMPLE.

The altars and idols are placed at the opposite end; and two long parallel benches, like cathedral stalls, run down the centre of the building: on these the monks sit at prayer and contemplation, the head Lama occupying a stall (often of very tasteful design) near the altar.

The principal Boodh, or image, is placed behind the altar under a canopy, or behind a silk screen: lesser gods, and gaily dressed and painted effigies of sainted male or female persons are ranged on either side, or placed in niches around the apartment, some-

times with separate altars before them; whilst the walls are more or less covered with paintings of monks in prayer or contemplation. The principal Boodh (Sakya Sing) sits cross-legged, with the left heel up: his left hand always rests on his thigh, and holds the padmi or lotus and jewel, which is often a mere cup; the right hand is either raised, with the two forefingers up, or holds the dorje, or rests on the calf of the upturned leg. Sakya has generally



ALTAR AND IMAGES.

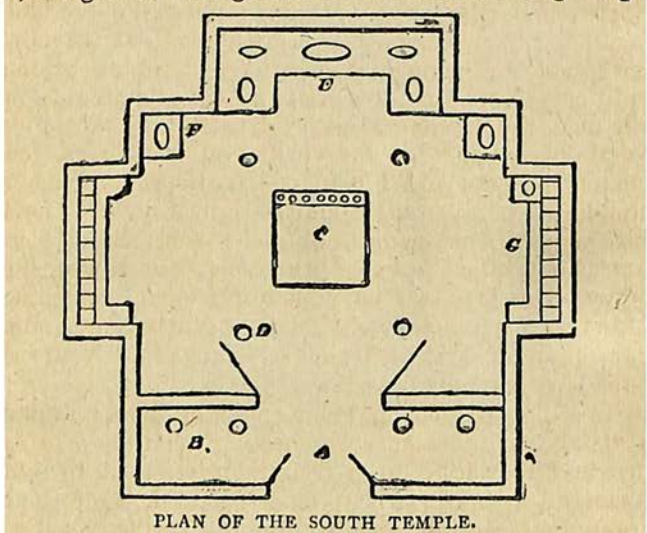
Central figure Akshobya, the first of the Pancha Boodha.

curled hair, Lamas have mitres, females various head-dresses; most wear immense ear-rings, and some rosaries. All are placed on rude pediments, so painted as to convey the idea of their rising out of the petals of the pink, purple, or white lotus. None are in any way disagreeable; on the contrary most have a calm and pleasing expression, suggestive of contemplation.

The great or south temple contained a side altar of very elegant

shape, placed before an image encircled by a glory. Flowers, juniper, peacock's feathers, pastiles, and rows of brass cups of water were the chief ornaments of the altars, besides the instruments I have elsewhere enumerated. In this temple was the library, containing several hundred books, in pigeon-holes, placed in recesses.[1]

The effect on entering these cold and gloomy temples is very impressive; the Dugang in particular is exquisitely ornamented and painted, and the vista from the vestibule to the principal idol, of carved and coloured pillars and beams, is very picturesque. Within, the general arrangement of the colours and gilding is felt



PLAN OF THE SOUTH TEMPLE.

A. entrance; B. four praying cylinders; C. altar, with seven brass cups of water; D. four columns; E. and F. images; G. library.

to be harmonious and pleasing, especially from the introduction of slender white streaks between the contrasting masses of colour, as adopted in the Great Exhibition building of 1851. It is also well worthy of remark that the brightest colours are often used in

[1] For a particular account of the images and decorations of these temples, see Dr. Campbell's paper in "Bengal Asiatic Society's Trans.," May, 1849. The principal object of veneration amongst the Ningma or red sect of Boodhists in Sikkim and Bhotan is Gorucknath, who is always represented sitting crossed-legged, holding the dorje in one hand, which is raised; whilst the left rests in the lap and holds a cup with a jewel in it. The left arm supports a trident, whose staff pierces three sculls (a symbol of Shiva), a rosary hangs round his neck, and he wears a red mitre with a lunar crescent and sun in front.

broad masses, and when so, are always arranged chromatically, in the sequence of the rainbow's hues, and are hence never displeasing to the eye. The hues, though bright, are subdued by the imperfect light; the countenances of the images are all calm, and their expression solemn. Whichever way you turn, the eye is met by some beautiful specimen of colouring or carving, or some object of veneration. The effect is much heightened by the incense of juniper and sweet-smelling herbs which the priests burn on entering, by their grave and decorous conduct, and by the feeling of respect that is demanded by a religion which theoretically inculcates and adores virtue in the abstract, and those only amongst men who practise virtue. To the idol itself the Boodhist attaches no real importance; it is an object of reverence, not of worship, and no virtue or attribute belong to it *per se;* it is a symbol of the creed, and the adoration is paid to the holy man whom it represents.

Beyond the temples are the chaits and mendongs, scattered without much order; and I counted nearly twenty-five chaits of the same form,[1] between eight and thirty feet high. The largest is consecrated to the memory of the Rajah's eldest son, who, however, is not buried here. A group of these structures is, as I have often remarked, extremely picturesque, and those at Tassiding, from their number, variety, and size, their commanding and romantic position, and their being interspersed with weeping cypresses, are particularly so.

The Tassiding temples and convents were founded upwards of 300 years ago, by the Lamas who accompanied the first Rajah to Sikkim; and they have been continuously served by Lamas of great sanctity, many of whom have been educated at Lhassa. They were formerly very wealthy; but during the Nepal war they were plundered of all their treasures, their silver gongs and bells, their best idols, dorjes, and manis, and stripped of their ornaments; since which time Pemiongchi has been more popular. In proof of their antiquity, it was pointed out that most of the symbols and decorations were those of pure Lama Boodhism, as practised in Tibet.

[1] In Sikkim the form of the cube alone is always strictly preserved; that of the pyramid and hemisphere being often much modified. The cube stands on a flight of usually three steps, and is surmounted by a low pyramid of five steps; on this is placed a swelling, urn-shaped body, which represents the hemisphere, and is surmounted by another cube. On the latter is a slender, round or angled spire (represented by a pyramid in Burma), crowned with a crescent and disc, or sun, in moon. Generally the whole is of stone, with the exception of the spire, which is of wood, painted red.

Although the elevation is but 4,840 feet, the weather was cold and raw, with rain at noon, followed by thunder and lightning. These electrical disturbances are frequent about midsummer and midwinter, prevailing over many parts of India.

January 1st, 1849.—The morning of the new year was bright and beautiful, though much snow had fallen on the mountains; and we left Sunnook for Pemiongchi, situated on the summit of a lofty spur on the opposite side of the Ratong. We descended very steeply to the bed of the river (alt. 2,480 feet) which joins the Great Rungeet below the convents. The rocks were micaceous, dipping west and north-west 45°, and striking north and north-east, which direction prevailed for 1,000 feet or so up the opposite spur. I had observed the same dip and strike on the east flank of the Tassiding spur; but both the Ratong on its west side, and the Great Rungeet on the east, flow in channels that show no relation to either the dip or strike. I have generally remarked in Sikkim that the channels of the rivers when cutting through or flowing at the base of bluff cliffs, are neither parallel to nor at right angles to the strike of the rocks forming the cliffs. I do not hence conclude that there is no original connection between the directions of the rivers, and the lines of fracture; but whatever may have once subsisted between the direction of the fissues and that of the strike, it is in the Sikkim Himalaya now wholly masked by shiftings, which accompanied subsequent elevations and depressions.

Mr. Hopkins has mathematically demonstrated that the continued exertion of a force in raising superimposed strata would tend to produce two classes of fractures in those strata; those of the first order at right angles to the direction of the wave or ridge (or line of strike); those of the second order parallel to the strike. Supposing the force to be withdrawn after the formation of the two fractures, the result would be a ridge, or mountain chain, with diverging fissures from the summit, crossed by concentric fissures; and the courses which the rivers would take in flowing down the ridge, would successively be at right angles and parallel to the strike of the strata. Now, in the Himalaya, a prevalent strike to the north-west has been recognised in all parts of the chain, but it is everywhere interfered with by mountains presenting every other direction of strike, and by their dip never remaining constant either in amount or direction. Consequently, as might be expected, the directions of the river channels bear no apparent relation to the general strike of the rocks.

We crossed the Ratong (twenty yards broad) by a cane bridge,

suspended between two rocks of green chlorite, full of veins of granite. Ascending, we passed the village of Kameti on a spur, on the face of which were strewed some enormous detached blocks of white and pink stratified quartz: the rocks *in situ* were all chlorite schist.

Looking across the valley to the flank of Mainom, the disposition of the ridges and ravines on its sides was very evident; many of the latter, throughout their westerly course, from their commencement at 10,000 feet, to their debouchure in the Great Rungeet at 2,000, had a bluff, cliffy, northern flank, and a sloping southern one. The dip of the surfaces is, therefore, north-west, the exposure consequently of the villages which occupy terraces on the south flanks of the lateral valleys. Tassiding spur presented exactly the same arrangement of its ravines, and the dip of the rocks being north-west, it follows that the planes of the sloping surfaces coincide in direction, (though not in amount of inclination) with that of the dip of the subjacent strata, which is anything but a usual phenomenon in Sikkim.

The ascent to Pemiongchi continued very steep, through woods of oaks, chesnuts, and magnolias, but no tree-fern, palms, *Pothos*, or plantain, which abound at this elevation on the moister outer ranges of Sikkim. The temple (elev. 7,083 feet) is large, eighty feet long, and in excellent order, built upon the lofty terminal point of the great east and west spur that divides the Kulhait from the Ratong and Rungbee rivers; and the great Changachelling temple and monastery stand on another eminence of the same ridge, two miles further west.

The view of the snowy range from this temple is one of the finest in Sikkim; the eye surveying at one glance the vegetation of the Tropics and the Poles. Deep in the valleys the river-beds are but 3,000 feet above the sea, and are choked with fig-trees, plantains, and palms; to these succeed laurels and magnolias, and higher up still, oaks, chestnuts, birches, &c.; there is, however, no marked line between the limits of these two last forests, which form the prevailing arboreous vegetation between 4,000 and 10,000 feet, and give a lurid hue to the mountains. Pine forests succeed for 2,000 feet higher, when they give place to a skirting of rhododendron and berberry. Among these appear black naked rocks, rising up in cliffs, between which are gulleys, down which the snow now (on the 1st January) descended to 12,000 feet. The mountain flanks are much more steep and rocky than those at similar heights on the outer ranges, and cataracts are very numerous, and of considerable height, though small in volume.

Pemiongchi is at the same elevation as Darjeeling, and the contrast between the shoulders of 8,000 to 10,000 feet on Kinchinjunga, and those of equal height on Tendong and Tonglo, is very remarkable: looking at the latter mountains from Darjeeling, the observer sees no rock, waterfall, or pine, throughout their whole height; whereas the equally wooded flanks of these inner ranges are rocky, streaked with threadlike waterfalls, and bristling with silver firs.

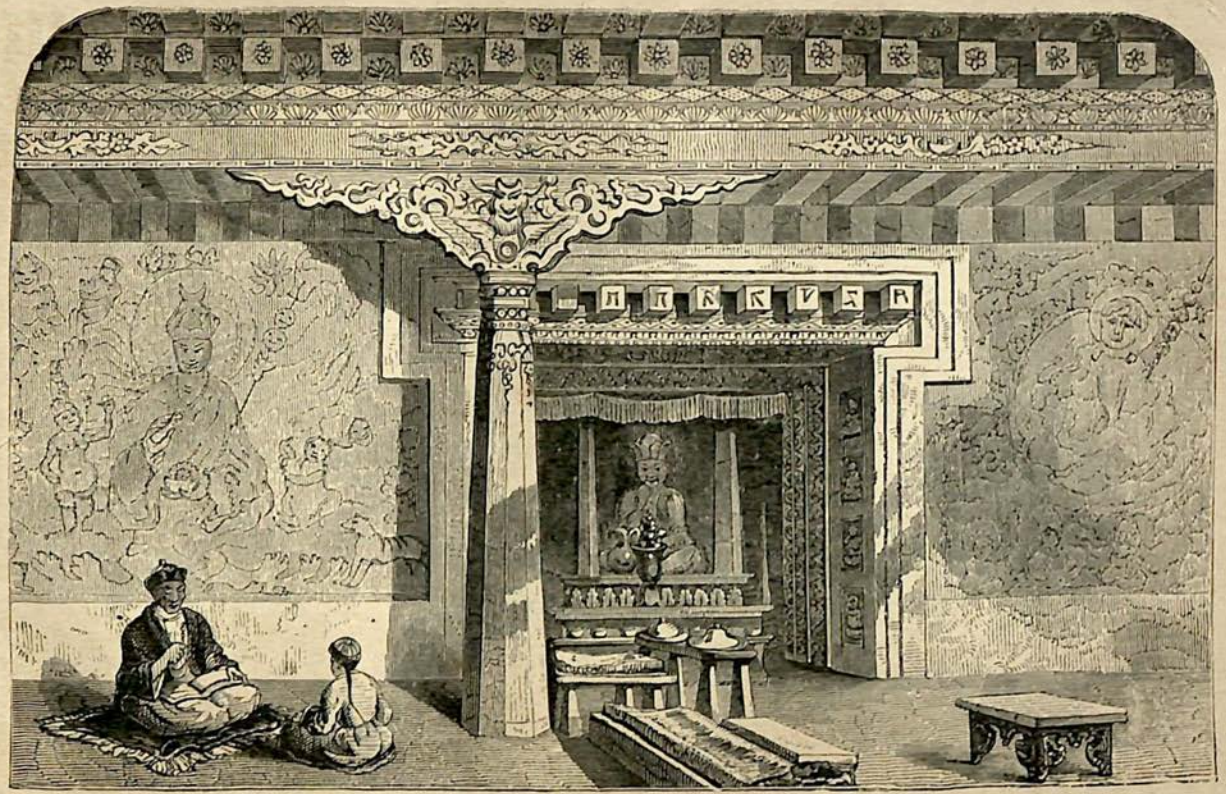
This temple, the most ancient in Sikkim, is said to be 400 years old; it stands on a paved platform, and is of the same form and general character as those of Tassiding. Inside, it is most beautifully decorated, especially the beams, columns, capitals and architraves, but the designs are coarser than those of Tassiding.[1] The square end of every beam in the roof is ornamented either with a lotus flower or with a Tibetan character, in endless diversity of colour and form, and the walls are completely covered with allegorical paintings of Lamas and saints expounding or in contemplation, with glories round their heads, mitred, and holding the dorje and jewel.

The principal image is a large and hideous figure of Sakya-thoba, in a recess under a blue silk canopy, contrasting with a calm figure of the late Rajah, wearing a cap and coronet.

Pemiongchi was once the capital of Sikkim, and called the Sikkim Durbar: the Rajah's residence was on a curious flat to the south of the temple, and a few hundred feet below it, where are the remains of (for this country) extensive walls and buildings. During the Nepal war, the Rajah was driven west across the Teesta, whilst the Ghorkas plundered Tassiding, Pemiongchi, Changachelling, and all the temples and convents to the east of that river. It was then that the famous history of Sikkim,[2] compiled by the Lamas of Pemiongchi, and kept at this temple, was destroyed, with the exception of a few sheets, with one of which Dr. Campbell and myself were each presented. We were told that the monks of Changachelling and those of this establishment had copied what remained, and were busy compiling from oral information, &c.: whatever value the original may have possessed,

[1] Mr. Hodgson informed me that many of the figures and emblems in this temple are those of Tantrica Boodhism, including Ṣhiva, Devi, and other deities usually called Brahminical; Katotak, or the snake king, a figure terminating below in a snake, is also seen; with the tiger, elephant, and curly-maned lion.

[2] This remarkable and beautiful manuscript was written on thick oblong sheets of Tibet paper, painted black to resist decay, and the letters were yellow and gold. The Nepalese soldiers wantonly employed the sheets to roof the sheds they erected, as a protection from the weather.



INTERIOR OF THE TEMPLE AT PEMIONGCHI.

however, is irretrievably lost. A magnificent copy of the Boodhist Scriptures was destroyed at the same time; it consisted of 400 volumes, each containing several hundred sheets of Daphne paper.

The ground about the temple was snowed; and we descended a few hundred feet, to encamp in a most picturesque grove, among chaits and inscribed stones, with a peep of the temples above. Nightingales warbled deliciously night and morning, which rather surprised us, as the minimum thermometer fell to 27·8°, and the ground next day was covered with hoar-frost; the elevation being 6,580 feet. These birds migrate hither in October and November, lingering in the Himalayan valleys till the cold of early spring drives them further south, to the plains of India, whence they return north in March and April.

On the 2nd of January I parted from my friend, who was obliged to hurry to the great annual fair at Titalya. I regretted much being unable to accompany Dr. Campbell to this scene of his disinterested labours, especially as the Nawab of Moorshedabad was to be present, one of the few wealthy native princes of Bengal who still keep a court worth seeing; but I was more anxious to continue my explorations northward till the latest moment: I however accompanied him for a short distance on his way towards Darjeeling. We passed the old Durbar, called Phieungoong ("Bamboo-hill," so called from the abundance of a small bamboo, "Phieung"). The buildings, now in ruins, occupy a little marshy flat, hemmed in by slate rocks, and covered with brambles and *Andromeda* bushes. A wall, a bastion, and an arched gateway, are the only traces of fortifications; they are clothed with mosses, lichens, and ferns.

A steep zigzag path, descending amongst long grass and scarlet rhododendrons, leads to the Kaysing Mendong.[1] Here I bade adieu to Dr. Campbell, and toiled up the hill, feeling very lonely. The zest with which he had entered into all my pursuits, and the aid he had afforded me, together with the charm that always attends companionship with one who enjoys every incident of travel, had so attracted me to him that I found it difficult to recover my spirits. It is quite impossible for any one who cannot from experience realise the solitary wandering life I had been leading for months, to appreciate the desolate feeling that follows the parting from one who has heightened every enjoyment, and taken far more than his share of every annoyance and discomfort. The few days we had spent together appeared then, and still, as months.

[1] Described at page 200.

On my return to Pemiongchi I spent the remainder of the day sketching in the great temple, gossiping with the Lamas, and drinking salted and buttered tea-soup, which I had begun to like, when the butter was not rancid.

My route hence was to be along the south flank of Kinchinjunga, north to Jongri, which lay about four or five marches off, on the road to the long deserted pass of Kanglanamo, by which I had intended entering Sikkim from Nepal, when I found the route up the Yalloong valley impracticable. The village and ruined convents of Yoksun lay near the route, and the temples of Doobdi, Catsuperri and Molli, on the Ratong river.

I descended to the village of Tchongpong (alt. 4,980 feet), where I was detained a day to obtain rice, of which I required ten days' supply for twenty-five people. On the way I passed groves of the paper-yielding *Edgeworthia Gardneri:* it bears round heads of fragrant, beautiful, yellow flowers, and would be a valuable acquisition to the English conservatory.

From Tchonpong we descended to the bed of the Rungbee (alt. 3,160 feet), an affluent of the Ratong, flowing in a deep gulley with precipitous sides of mica schist full of garnets, dipping west and north-west 45°: it was spanned by a bridge of two loose bamboo culms, about fifteen yards long, laid across without hand-rails; after wet sand had been thrown on it the bare-footed coolies crossed easily enough, but I, having shoes on, required a hand to steady me. From this point we crossed a lofty spur to the Ratong (alt. 3,000 feet), where we encamped, the coolies being unable to proceed further on such very bad roads. This river descends from the snows of Kinchin, and consequently retains the low temperature 42°, being fully 7° colder than the Rungbee, which at an elevation of but 3,000 feet, appears very remarkable: it must, however, be observed that scarcely anywhere does the sun penetrate to the bottom of its valley.

We encamped on a gravelly flat, fifty feet above the river, strewn with water-worn boulders, and so densely covered with tall *Artemisia*, gigantic grasses, bamboo, plantain, fern, and acacia, that we had to clear a space in the jungle, which exhaled a rank heavy smell.

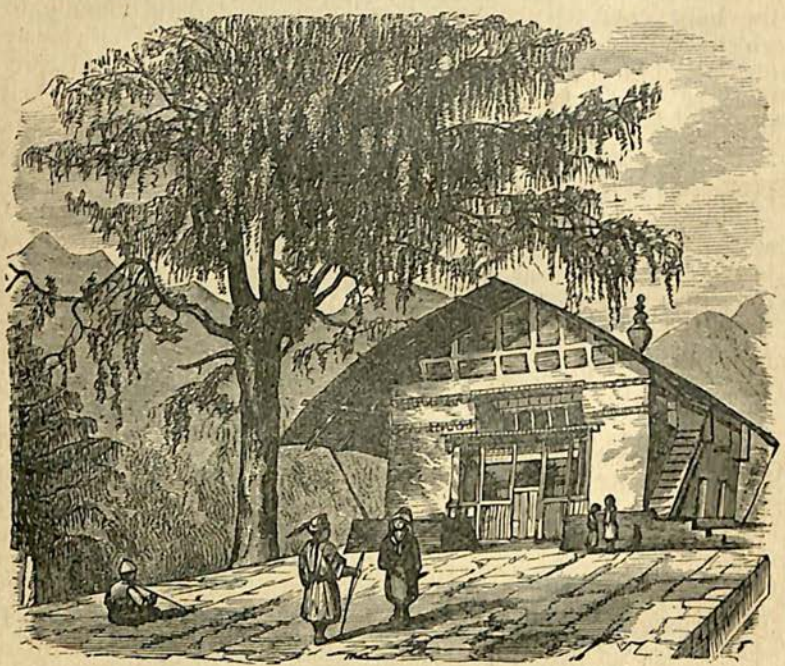
Hoar-frost formed copiously in the night, and though above the sun's rays were very powerful, they did not reach this spot till 7.30 A.M., the frost remaining in the shade till nearly 9 A.M.; and this on plantains, and other inhabitants of hot-houses in England.

Hence I ascended to Yoksun, one of the most curious and

picturesque spots in Sikkim, and the last inhabited place towards Kinchinjunga. The path was excessively steep and rocky for the first mile or two, and then alternately steep and flat. Mixed with many tropical trees, were walnuts of the common English variety; a tree which, though planted here, is wild near Darjeeling, where it bears a full-sized fruit, as hard as a hickory-nut: those I gathered in this place were similar, whereas in Bhotan the cultivated nut is larger, thin-shelled, and the kernel is easily removed. We ascended one slope, of an angle of 36° 30′, which was covered with light black mould, and had been recently cleared by fire; we found millet now cultivated on it. From the top the view of the Ratong valley was very fine: to the north lay Yoksun, appearing from this height to occupy a flat, two miles long and one broad, girdled by steep mountains to the north and east, dipping very suddenly 2,200 feet to the Ratong on the west. To the right was a lofty hill, crowned with the large temple and convents of Doobdi, shadowed by beautiful weeping cypresses, and backed by lofty pine-clad mountains. Northward, the gorge of the Ratong opened as a gloomy defile, above which rose partially snowed mountains, which shut out Kinchinjunga. To the west, massive pine-clad mountains rose steeply; while the little hamlet of Lathiang occupied a remarkable shelf overhanging the river, appearing inacessible except by ropes from above. South-west, the long spurs of Molli and Catsuperri, each crowned with convents or temples, descended from Singalelah; and parallel to them on the south, but much longer and more lofty, was the great mountain range north of the Kulhait, with the temples and convents of Pemiongchi, and Changachelling, towering in the air. The latter range dips suddenly to the Great Rungeet, where Tassiding, with its chaits and cypresses, closed the view. The day was half cloud, half sunshine, and the various effects of light and shade, now bringing out one or other of the villages and temples, now casting the deep valleys into darker gloom, was wonderfully fine.

Yoksun was the earliest civilised corner of Sikkim, and derived its name (which signifies in Lepcha "three chiefs") from having been the residence of three Lamas of great influence, who were the means of introducing the first Tibetan sovereign into the country. At present it boasts of but little cultivation, and a scattered population, inhabiting a few hamlets, 5,500 feet above the sea: beautiful lanes and paths wind everywhere over the gentle slopes, and through the copsewood that has replaced the timber-trees of a former period. Mendongs and chaits are very numerous, some of great size; and there are also the ruins of two very large temples,

near which are some magnificent weeping cypresses, eighty feet high. These fine trees are landmarks from all parts of the flat; they form irregular cones of pale bright green, with naked gnarled tops, the branches weep gracefully, but not like the picture in Macartney's Embassy to China, whence originated the famous willow-pattern of our crockery. The ultimate branchlets are very slender and pendulous; my Lepcha boys made elegant chaplets of them, binding the withes with scarlet worsted. The trunk is quite erect, smooth, cylindrical, and pine-like; it harbours



TEMPLE AND WEEPING CYPRESS.

no moss, but air-plants, Orchids, and ferns, nestle on the limbs, and pendulous lichens, like our beard-moss, wave from the branches.

In the evening I ascended to Doobdi. The path was broad, and skilfully conducted up a very steep slope covered with forest: the top, which is 6,470 feet above the sea, and nearly 1,000 above Yoksun, is a broad partially paved platform, on which stand two temples, surrounded by beautiful cypresses: one of these trees (perhaps the oldest in Sikkim) measured sixteen and a half feet in

girth, at five feet from the ground, and was apparently ninety feet high: it was not pyramidal, the top branches being dead and broken, and the lower limbs spreading; they were loaded with masses of white-flowered Cœlogynes, and Vacciniums. The younger trees were pyramidal.

I was received by a monk of low degree, who made many apologies for the absence of his superior, who had been ordered an eight years' penance and seclusion from the world, of which only three had passed. On inquiry, I learnt the reason for this; the holy father having found himself surrounded by a family, to which there would have been no objection, had he previously obtained a dispensation. As, however, he had omitted this preliminary, and was able to atone by prayer and payment, he had been condemned to do penance; probably at his own suggestion, as the seclusion will give him sanctity, and eventually lead to his promotion, when his error shall have been forgotten.

Both temples are remarkable for their heavily ornamented, two-storied porticos, which occupy nearly the whole of one end. The interior decorations are in a ruinous condition, and evidently very old; they have no Hindoo emblems.

The head Lama sent me a present of dried peaches, with a bag of walnuts, called "Koal-kun" by the Lepchas, and "Tagasching" by the Bhoteeas; the two terminations alike signifying "tree."

The view of Yoksun from this height was very singular: it had the appearance of an enormous deposit banked up against a spur to the south, and mountains to the east, and apparently levelled by the action of water: this deposit seemed as though, having once completely filled the valley of the Ratong, that river had cut a gorge 2,000 feet deep between it and the opposite mountain.

Although the elevation is so low, snow falls abundantly at Doobdi in the winter; I was assured that it has been known of the depth of five feet, a statement I consider doubtful; the quantity is, however, certainly greater than at equal heights about Darjeeling, no doubt owing to its proximity to Kinchinjunga.

I was amused here by watching a child playing with a popgun, made of bamboo, similar to that of quill, with which most English children are familiar, and which propels pellets by means of a spring-trigger made of the upper part of the quill. It is easy to conclude such resemblances between the familiar toys of different countries to be accidental, but I question their being really so. On the plains of India, men may often be seen for

hours together, flying what with us are children's kites; and I procured a jews'-harp from Tibet. These are not the toys of savages, but the amusements of people more than half-civilised, and with whom we have had indirect communication from the earliest ages. The Lepchas play at quoits, using slate for the purpose, and at the Highland games of "putting the stone" and "drawing the stone." Chess, dice, draughts, Punch, hockey, and battledore and shuttlecock, are all Indo-Chinese or Tartarian; and no one familiar with the wonderful instances of similarity between the monasteries, ritual, ceremonies, attributes, vestments, and other paraphernalia of the eastern and western churches, can fail to acknowledge the importance of recording even the most trifling analogies or similarities between the manners and customs of the young as well as of the old.

CHAPTER XV.

Leave Yoksun for Kinchinjunga—Ascend Ratong valley—Salt-smuggling over Ratong—Landslips—Plants—Buckeem—Blocks of gneiss—Mon Lepcha—View—Weather—View from Gubroo—Kinchinjunga, views of tops of—Pundim cliff—Nursing—Vegetation of Himalaya—Coup d'œil of Jongri—Route to Yalloong—Arduous route of salt-traders from Tibet—Kubra, ascent of—Lichens—Surfaces sculptured by snow and ice—Weather at Jongri—Snow—Shades for eyes.

I LEFT Yoksun on an expedition to Kinchinjunga on the 7th of January. It was evident that at this season I could not attain any height; but I was most anxious to reach the lower limit of that mass of perpetual snow which descends in one continuous sweep from 28,000 to 15,000 feet, and radiates from the summit of Kinchin, along every spur and shoulder for ten to fifteen miles, towards each point of the compass.

The route lay for the first mile over the Yoksun flat, and then wound along the almost precipitous east flank of the Ratong, 1,000 feet above its bed, leading through thick forest. It was often difficult, crossing torrents by culms of bamboo, and leading up precipices by notched poles and roots of trees. I wondered what could have induced the frequenting of such a route to Nepal, when there were so many better ones over Singalelah, till I found from my guide that he had habitually smuggled salt over this pass to avoid the oppressive duty levelled by the Dewan on all imports from Tibet by the eastern passes: he further told me that it took five days to reach Yalloong in Nepal from Yoksun, on the third

of which the Kanglanamo pass is crossed, which is open from April to November, but is always heavily snowed. Owing to this duty, and the remoteness of the eastern passes, the people on the west side of the Great Rungeet were compelled to pay an enormous sum for salt; and the Lamas of Changachelling and Pemiongchi petitioned Dr. Campbell to use his influence with the Nepal Court to have the Kanglanamo pass re-opened, and the power of trading with the Tibetans of Wallanchoon, Yangma, and Kambachen, restored to them: the pass having been closed since the Nepalese war, to prevent the Sikkim people from kidnapping children and slaves, as was alleged to be their custom.[1]

We passed some immense landslips, which had swept the forest into the torrent, and exposed white banks of angular detritus of gneiss and granite: we crossed one 200 yards long, by a narrow treacherous path, on a slope of 35°: the subjacent gneiss was nearly vertical, striking north-east. We camped at 6,670 feet, amongst a vegetation I little expected to find so close to the snows of Kinchin; it consisted of oak, maple, birch, laurel, rhododendron, white *Daphne*, jessamine, *Arum*, *Begonia*, *Cyrtandraceæ*, pepper, fig, *Menispermum*, wild cinnamon, *Scitamineæ*, several epiphytic orchids, vines, and ferns in great abundance.

On the following day, I proceeded north-west up the Ratong river, here a furious torrent, which we crossed, and then ascended a very steep mountain called "Mon Lepcha." Immense detached masses of gneiss, full of coarse garnets, lay on the slope, some of which were curiously marked with a series of deep holes, large enough to put one's fist in, and said to be the footprints of the sacred cow. They appeared to me to have been caused by the roots of trees, which spread over the rocks in these humid regions, and wear channels in the hardest material, especially when they follow the direction of its lamination or stratification.

I encamped at a place called Buckeem (alt. 8,650 ft.), in a forest of *Abies Brunoniana* and *Webbiana*, yew, oak, various rhododendrons, and small bamboo. Snow lay in patches at

[1] An accusation in which there was probably some truth; for the Sikkim Dingpun, who guided Dr. Campbell and myself to Mainom, Tassiding, &c., since kidnapped, or caused to be abducted, a girl of Brahmin parents, from the Mai valley of Nepal, a transaction which cost him some 300 rupees. The Nepal Durbar was naturally furious, the more so as the Dingpun had no caste, and was therefore abhorred by all Brahmins. Restitution was demanded through Dr. Campbell, who caused the incensed Dingpun to give up his paramour and her jewels. He vowed vengeance against Dr. Campbell, and found means to gratify it, as I shall hereafter show.

8,000 feet, and the night was cold and clear. On the following morning I continued the ascent, alternately up steeps and along perfectly level shelves, on which were occasionally frozen pools, surrounded with dwarf juniper and rhododendrons. Across one I observed the track of a yak in the snow; it presented two ridges, probably from the long hair of this animal, which trails on the ground, sweeping the snow from the centre of its path. At 11,000 feet the snow lay deep and soft in the woods of silver fir, and the coolies waded through it with difficulty.

Enormous fractured boulders of gneiss were frequent over the whole of Mon Lepcha, from 7,000 to 11,000 feet: they were of the same material as the rock *in situ*, and as unaccountable in their origin as the loose blocks on Darjeeling and Sinchul spurs at similar elevations, often cresting narrow ridges. I measured one angular detached block, forty feet high, resting on a steep narrow shoulder of the spur, in a position to which it was impossible it could have rolled; and it is equally difficult to suppose that glacial ice deposited it 4,000 feet above the bottom of the gorge; except we conclude the valley to have been filled with ice to that depth. A glance at the map will show that Mon Lepcha is remarkably situated, opposite the face of Kinchinjunga, and at the great bend of the Ratong. Had that valley ever been filled with water during a glacial period, Mon Lepcha would have formed a promontory, and many floating bergs from Kinchin would have been stranded on its flank; but I nowhere observed these rocks to be of so fine a granite as I believe the upper rocks of Kinchin to be, and I consequently cannot advance even that far-fetched solution with much plausibility.

As I ascended, the rocks became more granitic, with large crystals of mica. The summit was another broad bare flat, elevated 13,080 feet, and fringed by a copse of rose, berberry, and very alpine rhododendrons: the Himalayan heather (*Ardromeda fastigiata*) grew abundantly here, affording us good fuel.

The toilsome ascent through the soft snow and brushwood delayed the coolies, who scarcely accomplished five miles in the day. Some of them having come up by dark, I prepared to camp on the mountain-top, strewing thick masses of *Andromeda* and moss (which latter hung in great tufts from the bushes) on the snow; my blankets had not arrived, but there was no prospect of a snow-storm.

The sun was powerful when I reached the summit, and I was so warm that I walked about barefoot on the frozen snow without inconvenience, preferring it to continuing in wet stockings: the

temperature at the time was 29½°, with a brisk south-east moist wind, and the dew point 22° 8.

The night was magnificent, brilliant starlight, with a pale mist over the mountains: the thermometer fell to 15½° at 7½ P.M., and one laid upon wood, with its bulb freely exposed, sank to 7½°: the snow sparkled with broad flakes of hoar-frost in the full moon, which was so bright that I recorded my observations by its light. Owing to the extreme cold of radiation I passed a very uncomfortable night. The minimum thermometer fell to 1° in shade.[1] The sky was clear, and every rock, leaf, twig, blade of grass, and the snow itself, were covered with broad rhomboidal plates of hoar-frost, nearly one-third of an inch across: while the metal scale of the thermometer instantaneously blistered my tongue. As the sun rose, the light reflected from these myriads of facets had a splendid effect.

Before sunrise the atmosphere was still, and all but cloudless. To the south-east were visible the plains of India, at least 140 miles distant; where, as usual, horizontal layers of leaden purple vapour obscured the horizon: behind these the sun rose majestically, instantly dispersing them, while a thin haze spread over all the intervening mountains, from its slanting beams reaching me through otherwise imperceptible vapours: these, as the sun mounted higher, again became invisible, though still giving that transparency to the atmosphere and brilliant definition of the distances, so characteristic of a damp, yet clear day.

Mon Lepcha commands a most extensive view of Sikkim, southward to Darjeeling. At my feet lay the great and profound valley of the Ratong, a dark gulf of vegetation. Looking northward, the eye followed that river to the summit of Kinchinjunga (distant eighteen miles), which fronts the beholder as Mont Blanc does when seen from the mountains on the opposite side of the valley of Chamouni. To the east are the immense precipices and glaciers of Pundim, and on the west those of Kubra, forming great supporters to the stupendous mountain between them. Mon Lepcha itself is a spur running south-east from the Kubra shoulder: it is very open, and covered with rounded hills for several miles further north, terminating in a conspicuous conical black hummock[2]

[1] At sunrise the temperature was 11½°; that of grass, cleared on the previous day of snow, and exposed to the sky, 6½°; that on wool, 2° 2; and that on the surface of the snow, 0° 7.

[2] This I have been told is the true Kubra; and the great snowy mountain behind it, which I here, in conformity with the Darjeeling nomenclature, call Kubra, has no name, being considered a part of Kinchin.

called Gubroo, of 15,000 feet elevation, which presents a black cliff to the south.

Kinchinjunga rises in three heads, of nearly equal height,[1] which form a line running north-west. It exposes many white or grey rocks, bare of snow, and disposed in strata[2] sloping to the west; the colour of all which above 20,000 feet, and the rounded knobbed form of the summit, suggest a granitic formation. Lofty snowed ridges project from Kubra into the Ratong valley, presenting black precipices of stratified rocks to the southward. Pundim has a very grand appearance; being eight miles distant, and nearly 9,000 feet above Mon Lepcha, it subtends an angle of 12°; while Kinchin top, though 15,000 feet higher than Mon Lepcha, being eighteen miles distant, rises only 9° 30′ above the true horizon: these angular heights are too small to give much grandeur and apparent elevation to mountains, however lofty; nor would they do so in this case, were it not that the Ratong valley which intervenes, is seen to be several thousand feet lower, and many degrees below the real horizon.

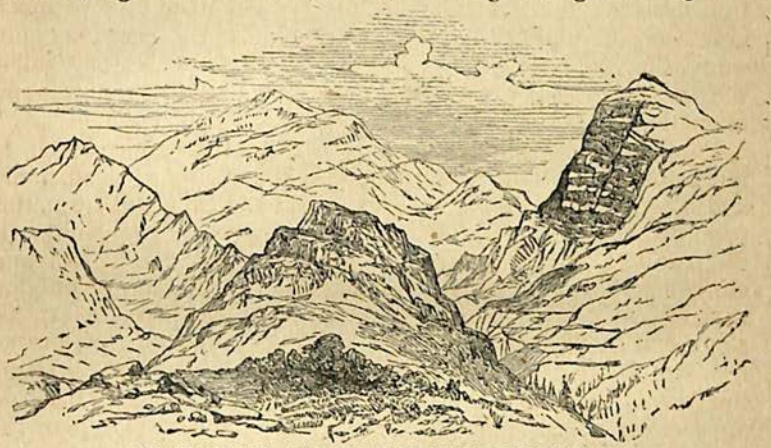
Pundim has a tremendous precipice to the south, which, to judge from its bareness of snow, must be nearly perpendicular; and it presented a superb geological section. The height of this precipice I found by angles with a pocket sextant to be upwards of 3,400 feet, and that of its top to be 21,300 above the sea, and consequently only 715 feet less than that of the summit of Pundim itself (which is 22,015 feet). The cliff is of black stratified rocks, sloping to the west, and probably striking north-west; permeated from top to bottom by veins of white granite, disposed in zigzag lines, which produce a contortion of the gneiss, and give it a marbled appearance. The same structure may be seen in miniature on the transported blocks which abound in the Sikkim rivers; where veins of finely grained granite are forced in all directions through the gneiss, and form parallel seams or beds between the laminæ

[1] The eastern and western tops are respectively 27,826 and 28,177 feet above the level of the sea.

[2] I am aware that the word strata is inappropriate here; the appearance of stratification or bedding, if it indicate any structure of the rock, being, I cannot doubt, due to that action which gives parallel cleavage planes to granite in many parts of the world, and to which the so-called lamination or foliation of slate and gneiss is supposed by many geologists to be due. It is not usual to find this structure so uniformly and conspicuously developed through large masses of granite, as it appeared to me to be on the sides of Kinchinjunga and on the top of Junnoo, as seen from the Choonjerma pass (p. 185, plate); but it is sometimes very conspicuous, and nowhere more than in the descent of the Grimsel towards Meyringen, where the granite on the east flank of that magnificent gorge seems cleft into parallel nearly vertical strata.

of that rock, united by transverse seams, and crumpling up the gneiss itself, like the crushed leaves of a book. The summit of Pundim itself is all of white rock, rounded in shape, and forming a cap to the gneiss, which weathers into precipices.

A succession of ridges, 14,000 to 18,000 feet high, presented a line of precipices running south from Pundim for several miles: immense granite veins are exposed on their surfaces, and they are capped by stratified rocks, sloping to the east, and apparently striking to the north-west, which, being black, contrast strongly with the white granite beneath them: these ridges, instead of being round-topped, are broken into splintered crags, behind above which rises the beautiful conical peak of Nursing, 19,139 feet the sea, eight miles distant, and subtending an angle of 8° 30′.



KINCHINJUNGA AND PUNDIM FROM MON LEPCHA.

At the foot of these precipices was a very conspicuous series of lofty moraines, round whose bases the Ratong wound; these appeared of much the same height, rising several hundred feet above the valley: they were comparatively level-topped, and had steep shelving rounded sides.

I have been thus particular in describing the upper Ratong valley, because it drains the south face of the loftiest mountain on the globe;[1] and I have introduced angular heights, and been precise in my details, because the vagueness with which all terms are usually applied to the apparent altitude and steepness of mountains and precipices, is apt to give false impressions. It is essen-

[1] Mount Everest (see p. 129) is now known to be a few hundred feet higher than Kinchinjunga.

tial to attend to such points where scenery of real interest and importance is to be described. It is customary to speak of peaks as towering in the air, which yet subtend an angle of very few degrees; of almost precipitous ascents, which, when measured, are found to be slopes of 18° or 20°; and of cliffs as steep and stupendous, which are inclined at a very moderate angle.

The effect of perspective is as often to deceive in details as to give truth to general impressions; and those accessories are sometimes wanting in nature, which, when supplied by art, give truth to the landscape. Thus, a streak of clouds adds height to a peak which should appear lofty, but which scarcely rises above the true horizon; and a belt of mist will sunder two snowy mountains which, though at very different distances, for want of a play of light and shade on their dazzling surfaces, and from the extreme transparency of the air in lofty regions, appear to be at the same distance from the observer.

The view to the southward from Mon Lepcha, including the country between the sea-like plains of India and the loftiest mountain on the globe, is very grand, and neither wanting in variety nor in beauty. From the deep valleys choked with tropical luxuriance to the scanty yak pasturage on the heights above, seems but a step at the first *coup-d'œil*, but resolves itself on a closer inspection into five belts: 1, palm and plantain; 2, oak and laurel; 3, pine; 4, rhododendron and grass; and 5, rock and snow. From the bed of the Ratong, in which grow palms with screw-pine and plantain, it is only seven miles in a direct line to the perpetual ice. From the plains of India, or outer Himalaya, one may behold snowy peaks rise in the distance behind a foreground of tropical forest; here, on the contrary, all the intermediate phases of vegetation are seen at a glance. Except in the Himalaya this is no common phenomenon, and is owing to the very remarkable depth of the river-beds. That part of the valley of the Ratong where tropical vegetation ceases, is but 4,000 feet above the sea, and though fully fifty miles as the crow flies (and perhaps 200 by the windings of the river) from the plains of India, is only eight in a straight line (and forty by the windings) from the snows which feed that river. In other words, the descent is so rapid, that in eight miles the Ratong waters every variety of vegetation, from the lichen of the poles to the palm of the tropics; whilst throughout the remainder of its mountain course, it falls from 4,000 to 300 feet, flowing amongst tropical scenery, through a valley whose flanks rise from 5,000 to 12,000 feet above its bed.

From Mon Lepcha we proceeded north-west towards Jongri, along a very open rounded bare mountain, covered with enormous boulders of gneiss, of which the subjacent rock is also composed. The soil is a thick clay full of angular stones, everywhere scooped out into little depressions which are the dry beds of pools, and are often strewed with a thin layer of pebbles. Black tufts of alpine aromatic rhododendrons of two kinds (*R. anthopogon* and *setosum*), with dwarf juniper, comprised all the conspicuous vegetation at this season.

After a two hours' walk, keeping at 13,000 feet elevation, we sighted Jongri.[1] There were two stone huts on the bleak face of the spur, scarcely distinguishable at the distance of half a mile from the great blocks around them. To the north Gubroo rose in dismal grandeur, backed by the dazzling snows of Kubra, which now seemed quite near, its lofty top (alt. 24,005 feet) being only eight miles distant. Much snow lay on the ground in patches, and there were few remains of herbaceous vegetation; those I recognised were chiefly of poppy, *Potentilla*, gentian, geranium, fritillary, *Umbelliferæ*, grass, and sedges.

On our arrival at the huts the weather was still fine, with a strong north-west wind, which meeting the warm moist current from the Ratong valley, caused much precipitation of vapour. As I hoped to be able to visit the surrounding glaciers from this spot, I made arrangements for a stay of some days. Giving up the only habitable hut to my people, I spread my blankets in a slope from its roof to the ground, building a little stone dyke round the skirts of my dwelling, and a fire-place in front.

Hence to Yalloong in Nepal, by the Kanglanamo pass, is two days' march: the route crosses the Singalelah range at an elevation of about 15,000 feet, south of Kubra, and north of a mountain that forms a conspicuous feature south-west from Jongri, as a crest of black fingered peaks, tipped with snow.

It is difficult to conceive the amount of labour expended upon

[1] I am assured by Captain Sherwill, who, in 1852, proceeded along and surveyed the Nepal frontier beyond this point to Gubroo, that this is not Jongri, but Yangpoong. The difficulty of getting precise information, especially as to the names of seldom-visited spots, is very great. I was often deceived myself, undesignedly, I am sure, on the part of my informants; but in this case I have Dr. Campbell's assurance, who has kindly investigated the subject, that there is no mistake on my part. Captain Sherwill has also kindly communicated to me a map of the head waters of the Rungbee, Yungya, and Yalloong rivers, of which, being more correct than my own, I have gladly availed myself for my map. Gubroo, he informs me, is 15,000 feet in altitude, and dips in a precipice 1,000 feet high, facing Kubra, which prevented his exploring further north.

every pound of salt imported into this part of Sikkim from Tibet, and as an enumeration of the chief features of the routes it must follow, will give some idea of what the circuit of the loftiest mountain in the globe involves, I shall briefly allude to them; premising that the circuit of Mont Blanc may be easily accomplished in four days. The shortest route to Yoksun (the first village south of Kinchin) from the nearest Tibetan village north of that mountain, involves a detour of one-third of the circumference of Kinchin. It is evident that the most direct way must be that nearest the mountain-top, and therefore that which reaches the highest accessible elevation on its shoulders, and which, at the same time, dips into the shallowest valleys between those shoulders. The actual distance in a straight line is about fifty miles, from Yoksun to the mart at or near Tashirukpa.

The marches between them are as follows:—

1. To Yalloong two days; crossing Kanglanamo pass, 15,000 feet high.

3. To foot of Choonjerma pass, descending to 10,000 feet.

4. Cross Choonjerma pass, 15,260 feet, and proceed to Kambachen, 11,400 feet.

5. Cross Nango pass, 15,770, and camp on Yangma river, 11,000 feet.

6. Ascend to foot of Kanglachem pass, and camp at 15,000 feet.

7. Cross Kanglachem pass, probably 16,500 feet; and

8–10. It is said to be three marches hence to the Tibetan custom-house, and that two more snowy passes are crossed.

This allows no day of rest, and gives only five miles—as the crow flies—to be accomplished each day, but I assume fully fourteen of road distance; the labour spent in which would accomplish fully thirty over good roads. Four snowed passes at least are crossed, all above 15,000 feet, and after the first day the path does not descend below 10,000 feet. By this route about one-third of the circuit of Kinchinjunga is accomplished. Supposing the circuit were to be completed by the shortest practicable route, that is, keeping as near the summit as possible, the average time required for a man with his load would be upwards of a month.

To reach Tashirukpa by the eastern route from Yoksun, being a journey of about twenty-five days, requires a long detour to the southward and eastward, and afterwards the ascent of the Teesta valley, to Kongra Lama, and so north to the Tibetan Arun.

My first operation after encamping and arranging my instru-

ments, was to sink the ground thermometer; but the earth being frozen to sixteen inches, it took four men several hours' work with hammer and chisel, to penetrate so deep. There was much vegetable matter for the first eight or ten inches, and below that a fine red clay. I spent the afternoon, which was fine, in botanising. When the sun shone, the smell of the two rhododendrons was oppressive, especially as a little exertion at this elevation brings on headache. There were few mosses; but crustaceous lichens were numerous, and nearly all of them of Scotch, Alpine, European, and Arctic kinds. The names of these, given by the classical Linnæus and Wahlenberg, tell in some cases of their birth-places, in others of their hardihood, their lurid colours and weather-beaten aspects; such as *tristis*, *gelida*, *glacialis*, *arctica*, *alpina*, *saxatilis*, *polaris*, *frigida*, and numerous others equally familiar to the Scotch botanist. I recognised many as natives of the wild mountains of Cape Horn, and the rocks of the stormy Antarctic ocean; since visiting which regions I had not gathered them. The lichen called *geographicus* was most abundant, and is found to indicate a certain degree of cold in every latitude; descending to the level of the sea in latitude 52° north, and 50° south, but in lower latitudes only to be seen on mountains. It flourishes at 10,000 feet on the Himalaya, ascending thence to 18,000 feet. Its name, however, was not intended to indicate its wide range, but the curious maplike patterns which its yellow crust forms on the rock.

Of the blocks of gneiss scattered over the Jongri spur, many are twenty feet in diameter. The ridge slopes gently south-west to the Choroong river, and more steeply north-east to the Ratong, facing Kinchin: it rises so very gradually to a peaked mountain between Jongri and Kubra, that it is not possible to account for the transport and deposit of these boulders by glaciers of the ordinary form, viz., by a stream of ice following the course of a valley; and we are forced to speculate upon the possibility of ice having capped the whole spur, and moved downwards, transporting blocks from the prominences on various parts of the spur.

The cutting up of the whole surface of this rounded mountain into little pools, now dry, of all sizes, from ten to about one hundred yards in circumference, is a very striking phenomenon. The streams flow in shallow transverse valleys, each passing through a succession of such pools, accompanying a step-like character of the general surface. The beds are stony, becoming more so where they enter the pools, upon several of the larger of which I observed curving ridges of large stones, radiating out-

wards on to their beds from either margin of the entering stream: more generally large stones were deposited opposite every embrochure.

This superficial sculpturing must have been a very recent operation; and the transport of the heavy stones opposite the entrance of the streams has been effected by ice, and perhaps by snow; just as the arctic ice strews the shores of the Polar ocean with rocks.

The weather had been threatening all day, northern and westerly currents contending aloft with the south-east trade-wind of Sikkim, and meeting in strife over the great upper valley of the Ratong. Stately masses of white cumuli wheeled round that gulf of glaciers, partially dissipating in an occasional snow-storm, but on the whole gradually accumulating.

On my arrival the thermometer was 32°, with a powerful sun shining, and it fell to 28° at 4 P.M., when the north wind set in. At sunset the moon rose through angry masses of woolly cirrus; its broad full orb threw a flood of yellow light over the serried tops south of Pundim; thence advancing obliquely towards Nursing, "it stood tiptoe" for a few minutes on that beautiful pyramid of snow, whence it seemed to take flight and mount majestically into mid-air, illuminating Kinchin, Pundim, and Kubra.

I sat at the entrance of my gipsy-like hut, anxiously watching the weather, and absorbed in admiration of the moonrise, from which my thoughts were soon diverted by its fading light as it entered a dense mass of mare's-tail cirrus. It was very cold, and the stillness was oppressive. I had been urged not to attempt such an ascent in January, my provisions were scanty, firewood only to be obtained from some distance, the open undulating surface of Jongri was particularly exposed to heavy snow-drifts, and the path was, at the best, a scarcely perceptible track. I followed every change of the wind, every fluctuation of the barometer and thermometer, each accession of humidity, and the courses of the clouds aloft. At 7 P.M., the wind suddenly shifted to the west, and the thermometer instantly rose from 20° to 30°. After 8 P.M., the temperature fell again, and the wind drew round from west by south to north-east, when the fog cleared off. The barometer rose no more than it usually does towards 10 P.M., and though it clouded again. with the temperature at 17°, the wind seemed steady, and I went to bed with a relieved mind.

Jan. 10.—During the night the temperature fell to 11° 2, and at 6 A.M. was 19° 8, falling again to 17° soon after. Though

clouds were rapidly coming up from the west and south-west, the wind remained northerly till 8 A.M., when it shifted to south-west, and the temperature rose to 25°. As it continued fine, with the barometer high, I ventured on a walk towards Gubroo, carefully taking bearing of my position. I found a good many plants in a rocky valley close to that mountain, which I in vain attempted to ascend. The air was 30°, with a strong and damp south-west wind, and the cold was so piercing, that two lads who were with me, although walking fast, became benumbed, and could not return without assistance. At 11 A.M., a thick fog obliged us to retrace our steps: it was followed by snow in soft round pellets like

MAITRYA, THE SIXTH OR COMING BOODH.

sago, that swept across the hard ground. During the afternoon it snowed unceasingly, the wind repeatedly veering round the compass, always from west to east by south, and so by north to west again. The flakes were so large, soft, and moist with the south wind, and small, hard, and dry with the north. Glimpses of blue sky were constantly seen to the south, under the gloomy canopy above, but they augured no change. As darkness came on, the temperature fell to 15°, and it snowed very hard; at 6 P.M., it was 11°, but rose afterwards to 18°.

The night was very cold and wintry: I sat for some hours

behind a blanket screen (which had to be shifted every few minutes) at my tent-door, keeping up a sulky fire, and peering through the snow for signs of improvement, but in vain. The clouds were not dense, for the moon's light was distinct, shining on the glittering snow-flakes that fell relentlessly: my anxiety was great, and I could not help censuring myself severely for exposing a party to so great danger at such a season. I found comfort in the belief that no idle curiosity had prompted me, and that with a good motive and a strong prestige of success, one can surmount a host of difficulties. Still the snow fell; and my heart sank, as my fire declined, and the flakes sputtered on the blackening embers; my little puppy, who had gamboled all day amongst the drifting white pellets, now whined, and crouched under my thick woollen cloak; the inconstant searching wind drifted the snow into the tent, whose roof so bagged in with the accumulation that I had to support it with sticks, and dreaded being smothered, if the weight should cause it to sink upon my bed during my sleep. The increasing cold drove me, however, to my blankets, and taking the precaution of stretching a tripod stand over my head, so as to leave a breathing hole, by supporting the roof if it fell in, I slept soundly, with my dog at my feet.

At sunrise the following morning the sky was clear, with a light north wind; about two feet of snow had fallen, the drifts were deep, and all trace of the path obliterated. The minimum thermometer had fallen to 3° 7, the temperature rose to 27° at 9 A.M., after which the wind fell, and with it the thermometer to 18°. Soon, however, southerly breezes set in, bringing up heavy masses of clouds.

My light-hearted companions cheerfully prepared to leave the ground; they took their appointed loads without a murmur, and sought protection for their eyes from the glare of the newly fallen snow, some with as much of my crape veil as I could spare, others with shades of brown paper, or of hair from the yaks' tails, whilst a few had spectacle-shades of woven hair; and the Lepchas loosened their pigtails, and combed their long hair over their eyes and faces. It is from fresh-fallen snow alone that much inconvenience is felt; owing, I suppose, to the light reflected from the myriads of facets which the crystals of snow present. I have never suffered inconvenience in crossing beds of old snow, or glaciers with weathered surfaces, which absorb a great deal of light, and reflect comparatively little, and that little coloured green or blue.

The descent was very laborious, especially through the several

miles of bush and rock which lie below the summit: so that, although we started at 10 A.M., it was dark by the time we reached Buckeem, where we found two lame coolies, whom we had left on our way up, and who were keeping up a glorious fire for our reception.

CHAPTER XVI.

Ratong river below Mon Lepcha—Ferns—Vegetation of Yoksun, tropical—*Araliaceæ*, fodder for cattle—Rice-paper plant—Geology of Yoksun—Lake—Old temples—Funereal cypresses—Gigantic chait—Altars—Songboom—Weather—Catsuperri—Velocity of Ratong—Worship at Catsuperri lake—Scenery—Willow—Lamas and ecclesiastical establishments of Sikkim—Tengling—Changachelling temples and monks—Portrait of myself on walls—Block of mica-schist—Lingcham Kajee asks for spectacles—Hee-hill—Arrive at Little Rungeet—At Darjeeling—Its deserted and wintry appearance.

ON the following day we marched to Yoksun: the weather was fair, though it was evidently snowing on the mountains above. I halted at the Ratong river, at the foot of Mon Lepcha, where I found its elevation to be 7,150 feet; its edges were frozen, and the temperature of the water 36°; it is here a furious torrent flowing between gneiss rocks which dip south-south-east, and is flanked by flat-topped beds of boulders, gravel and sand, twelve to fourteen feet thick. Its vegetation resembles that of Darjeeling, but is more alpine, owing no doubt to the proximity of Kinchinjunga. The magnificent *Rhododendron argenteum* was growing on its banks. On the other hand, I was surprised to see a beautiful fern (a *Trichomanes*, very like the Irish one) which is not found at Dasjeeling. The same day, at about the same elevation, I gathered sixty species of fern, many of very tropical forms.[1] No doubt the range of such genera is extended in proportion to the extreme damp and equable climate, here, as about Darjeeling. Tree-ferns are, however, absent, and neither plantains, epiphytical *Orchideæ*, nor palms, are so abundant, or ascend so high as on the outer ranges. About Yoksun itself, which occupies a very warm sheltered flat, many tropical genera occur, such as tall bamboos of two kinds, grasses allied to the sugar-cane, scarlet *Erythrina*, and various *Araliaceæ*, amongst which was one species whose pith was of so curious a structure, that I had no hesitation

[1] They consisted of the above-mentioned *Trichomanes*, three *Hymenophylla*, *Vittaria*, *Pleopeltis*, and *Marattia*, together with several *Selaginellas*.

in considering the then unknown Chinese substance called rice-paper to belong to a closely allied plant.[1]

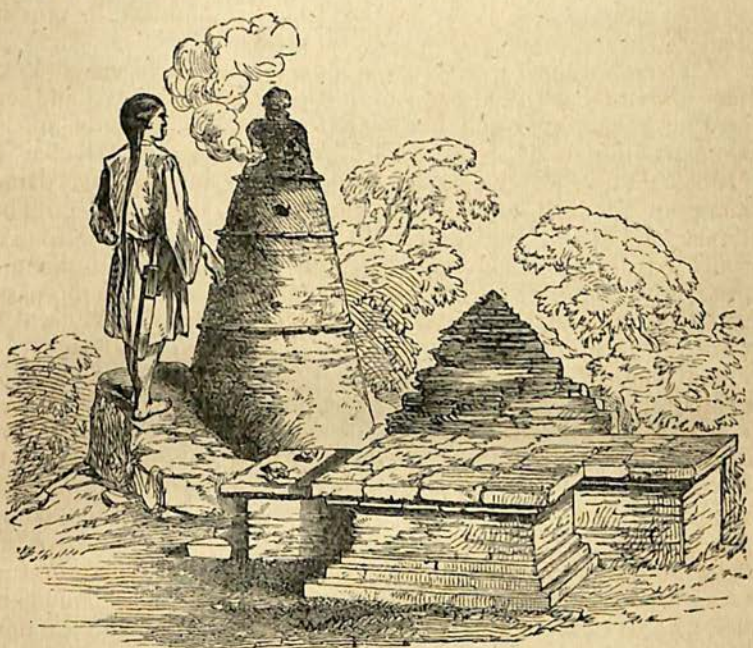
The natives collect the leaves of many Aralias as fodder for cattle, for which purpose they are of the greatest service in a country where grass for pasture is so scarce; this is the more remarkable, since they belong to the natural family of ivy, which is usually poisonous; the use of this food, however, gives a peculiar taste to the butter. In other parts of Sikkim, fig-leaves are used for the same purpose, and branches of a bird-cherry (*Prunus*), a plant also of a very poisonous family, abounding in prussic acid.

We were received with great kindness by the villagers of Yoksun, who had awaited our return with some anxiety, and on hearing of our approach had collected large supplies of food; amongst other things were tares (called by the Lepchas "Kullai"), yams ("Book"), and a bread made by bruising together damp maize and rice into tough thin cakes ("Katch-ung tapha"). The Lamas of Doobdi were especially civil, having a favour to ask, which was that I would intercede with Dr. Campbell to procure the permission of the Nepalese to reopen the Kanglanamo pass, and thus give some occupation to their herds of yaks, which were now wandering idly about.

I botanized for two days on the Yoksun flat, searching for evidence of lacustrine strata or moraines, being more than ever convinced by the views I had obtained of this place from Mon Lepcha, that its uniformity of surface was due to water action. It is certainly the most level area of its size that I know of in Sikkim, though situated in one of the deepest valleys, and surrounded on almost all sides by very steep mountains; and it is far above the flat gravel terraces of the present river-beds. I searched the surface of the flat for gravel beds in vain, for though it abounds in depressions that must have formerly been lake-beds, and are now marshes in the rainy season, these were all floored with clay. Along the western edge, where the descent is very steep for 1,800 feet to the Ratong, I found no traces of stratified deposits, though the spurs which projected from it were often flattened at top. The only existing lake has sloping clay banks, covered with spongy

[1] The Chinese rice-paper has long been known to be cut from cylinders of pith which has always a central hollow chamber, divided into compartments by septa or excessively thin plates. It is only within the last few months that my supposition has been confirmed, by my father's receiving from China, after many years of correspondence, specimens of the rice-paper plant itself, which very closely resemble, in botanical characters, as well as in outward appearance of size and habit, the Sikkim plant.

vegetable mould; it has no permanent affluent or outlet, its present drainage being subterranean, or more probably by evaporation; but there is an old water-channel several feet above its level. It is eighty to a hundred yards across, and nearly circular; its depth three or four feet, increased to fifteen or sixteen in the rains; like all similar pools in Sikkim, it contains little or no animal life at this season, and I searched in vain for shells, insects, or frogs. All around were great blocks of gneiss, some fully twelve feet square.



ALTAR AND SONG-BOOM AT YOKSUN.

The situation of this lake is very romantic, buried in a tall forest of oaks and laurels, and fringed by wild camellia shrubs; the latter are not the leafy, deep green, large-blossomed plants of our greenhouses, but twiggy bushes with small scattered leaves, and little yellowish flowers like those of the tea-plant. The massive walls of a ruined temple rise close to the water, which looks like the still moat of a castle: beside it are some grand old funereal cypresses, with ragged scattered branches below, where they

struggle for light in the dense forest, but raising their heads aloft as bright green pyramids.

After some difficulty I found the remains of a broad path that divided into two; one of them led to a second ruined temple, fully a mile off, and the other I followed to a grove, in which was a gigantic chait; it was a beautiful lane throughout, bordered with bamboo, brambles, gay-flowered *Melastomaceæ* like hedge-roses, and scarlet *Erythrina:* there were many old mendongs and chaits on the way, which I was always careful to leave on the right hand in passing, such being the rule among Boodhists, the same which ordains that the praying-cylinder or "Mani" be made to revolve in a direction against the sun's motion.

This great chait is the largest in Sikkim; it is called "Nirbogong," and appears to be fully forty feet high; facing it is a stone altar about fifteen feet long and four broad, and behind this again is a very curious erection called "Song-boom," used for burning juniper as incense; it resembles a small smelting furnace, and consists of an elongated conical stone building eight feet high, raised on a single block; it is hollow, and divided into three stories or chambers; in the lower of which is a door by which fuel is placed inside, and the smoke ascending through holes in the upper slabs, escapes by lateral openings from the top compartment. These structures are said to be common in Tibet, but I saw no other in Sikkim.

During my stay at Yoksun the weather was very cold, especially at night, considering the elevation (5,600 feet): the mean temperature was 39°, the extremes being 19° 2 and 60°; and even at 8 A.M. the thermometer, laid on the frosty grass, stood at 20°; temperatures which are at Darjeeling 1,500 feet higher. I could not but regard with surprise such half-tropical genera as perennial-leaved vines, *Saccharum*, *Erythrina*, large bamboos, *Osbeckia* and cultivated millet resisting such low temperatures.[1]

On the 14th January I left Yoksun for the lake and temples of Catsuperri, the former of which is by much the largest in Sikkim. After a steep descent of 1,800 feet, we reached the Ratong, where its bed is only 3,790 feet above the sea; it is here a turbulent stream, twelve yards across, with the usual features of gravel terraces, huge boulders of gneiss and some of the same rock *in situ*, striking north-east. Some idea of its velocity may be formed

[1] This is no doubt due to the temperature of the soil being always high: I did not sink a thermometer at Yoksun, but from observations taken at similar elevations, the temperature of the earth, at three feet depth, may be assumed to be 55°.

from the descent it makes from the foot of Mon Lepcha, where the elevation of its bed was 7,150 feet, giving a fall of 3,350 feet in only ten miles.

Hence I ascended a very steep spur, through tropical vegetation, now become so familiar to me that I used to count the number of species belonging to the different large natural orders as I went along. I gathered only thirty-five ferns at these low elevations in the same space as produces from fifty to sixty in the more equable and humid regions of 6,000 feet; grasses, on the other hand, were much more numerous. The view of the flat of Yoksun from Lungschung village, opposite to it, and on about the same level, is curious; as is that of the hamlet of Lathiang on the same side, which I have before noticed as being placed on a very singular flat shelf above the Ratong, and is overhung by rocks.

Ascending very steeply for several thousand feet, we reached a hollow on the Catsuperri spur, beyond which the lake lies buried in a deep forest. A Lama from the adjacent temple accompanied us, and I found my people affecting great solemnity as they approached its sacred bounds; they incessantly muttered "Om mani," &c., kotowed to trees and stones, and hung bits of rag on the bushes. A pretence of opposing our progress was made by the priest, who of course wanted money; this I did not appear to notice, and after a steep descent we were soon on the shores of what is, for Sikkim, a grand sheet of water, (6,040 feet above the sea), without any apparent outlet: it may be from three to five hundred yards across in the rains, but was much less now, and was bordered by a broad marsh of bog moss (*Sphagnum*), in which were abundance of *Azolla*, colouring the waters red, and sedges. Along the banks were bushes of *Rhododendron barbatum* and *Berberis insignis*,[1] but the mass of the vegetation was similar to that of Darjeeling.

We crossed the marsh to the edge of the lake by a rude paved way of decaying logs, through which we often plunged up to our knees. The Lama had come provided with a piece of bark, shaped like a boat, some juniper incense and a match-box, with which he made a fire, and put it in the boat, which he then launched on the lake as a votive offering to the presiding deity. It was a dead calm, but the impetus he gave to the bark shot it far across the lake, whose surface was soon covered with a thick cloud of white smoke. Taking a rupee from me, the priest then

[1] This magnificent new species has not been introduced into England; it forms a large bush, with deep-green leaves seven inches long, and bunches of yellow flowers.

waved his arm aloft, and pretended to throw the money into the water, singing snatches of prayers in Tibetan, and at times shrieking at the top of his voice to the Dryad who claims these woods and waters as his own. There was neither bird, beast, nor insect to be seen, and the scenery was as impressive to me as the effect of the simple service was upon my people, who prayed with redoubled fervour, and hung more rags on the bushes.

I need hardly say that this invocation of the gods of the woods and waters forms no part of Lama worship; but the Lepchas are only half Boodhists; in their hearts they dread the demons of the grove, the lake, the snowy mountain and the torrent, and the crafty Lama takes advantage of this, modifies his practices to suit their requirements, and is content with the formal recognition of the spiritual supremacy of the church. This is most remarkably shown in their acknowledgment of the day on which offerings had been made from time immemorial by the pagan Lepchas to the genius of Kinchinjunga, by holding it as a festival of the church throughout Sikkim.[1]

The two Catsuperri temples occupy a spur 445 feet above the lake, and 6,485 feet above the sea; they are poor, and only remarkable for a miserable weeping-willow tree planted near them, said to have been brought from Lhassa. The monks were very civil to me, and offered amongst other things a present of excellent honey. One was an intelligent man, and gave me much information: he told me that there were upwards of twenty religious establishments in Sikkim, containing more than 1,000 priests. These have various claims upon the devout: thus, Tassiding, Doobdi, Changachelling, and Pemiongchi are celebrated for their antiquity, and the latter also for being the resi-

[1] On that occasion an invocation to the mountain is chanted by priests and people in chorus. Like the Lama's address to the genius of Catsuperri lake, its meaning, if it ever had any, is not now apparent. It runs thus:—

"Kanchin-jinga, Pemi Kadup
Gnetche Tangla, Dursha tember
Zu jinga Pemsum Serkiem
Dischze Kubra Kanchin tong."

This was written for me by Dr. Campbell, who, like myself, has vainly sought its solution; it is probably a mixture of Tibetan and Lepcha, both as much corrupted as the celebrated "Om mani padmi hoom," which is universally pronounced by Lepchas "Menny pemmy hoom." This reminds me that I never got a solution of this sentence from a Lama, of whatever rank or learning; and it was only after incessant inquiry, during a residence of many years in Nepal, that Mr. Hodgson at last procured the interpretation, or rather paraphrase: "Hail to him (Sakya) of the lotus and the jewel," which is very much the same as M. Klaproth and other authorities have given.

dence of the head Lama; Catsuperri for its lake; Raklang for its size, &c. All are under one spiritual head, who is the Tupgain Lama, or eldest son of the Rajah; and who resides at the Phadong convent, near Tumloong: the Lama of Pemiongchi is, however, the most highly respected, on account of his age, position, and sanctity. Advancement in the hierarchy is dependent chiefly on interest, but indirectly on works also; pilgrimages to Lhassa and Teshoo Loombo are the highest of these, and it is clearly the interest of the supreme pontiffs of those ecclesiastical capitals to encourage such, and to intimate to the Sikkim authorities the claims those who perform them have for preferment. Dispensations for petty offences are granted to Lamas of low degree and monks by those of higher station, but crimes against the church are invariably referred to Tibet, and decided there.

The election to the Sikkim Lamaseries is generally conducted on the principle of self-government, but Pemiongchi and some others are often served by Lamas appointed from Tibet, or ordained there, at some of the great convents. I never heard of an instance of any Sikkim Lama arriving at such sanctity as to be considered immortal, and to reappear after death in another individual, nor is there any election of infants. All are of the Ningma, Dookpa, or Shammar sect, and are distinguished by their red mitres; they were once dominant throughout Tibet, but after many wars[1] with the yellow-caps, they were driven from

[1] The following account of the early war between the red and the yellow-mitred Lamas was given me by Tchebu Lama:—For twenty-five generations the red-caps (Dookpa or Ningma) prevailed in Tibet, when they split into two sects, who contended for supreme power; the Lama of Phado, who headed the dissenters, and adopted a yellow mitre, being favoured by the Emperor of China, to whom reference was made. A persecution of the red Lamas followed, who were caught by the yellow-caps, and their mitres plunged into dyeing vats kept always ready at the Lamaseries. The Dookpa, however, still held Teshoo Loombo, and applied to the Sokpo (North Tibet) Lamas for aid, who, bringing horses and camels, easily prevailed over the Gelookpa or yellow sect, but afterwards treacherously went over to them, and joined them in an attack on Teshoo Loombo, which was plundered and occupied by the Gelookpas. The Dookpa thereafter took refuge in Sikkim and Bhotan, whence the Bhotan Rajah became their spiritual chief under the name of Dhurma Rajah, and is now the representative of that creed. Goorucknath is still the Dookpa's favourite spiritual deity of the older creed, which is, however, no longer in the ascendant. The Dalai Lama of Teshoo Loombo is a Gelookpa, as is the Rimbochay Lama, and the Potala Lama of Lhassa, according to Tchebu Lama, but Turner ("Travels in Tibet," p. 315) says the contrary; the Gelookpa consider Sakya Thoba (or Tsongkaba), alias Mahamouni, as their great avatar.

that country, and took refuge principally in the Himalaya. The Bhotan or Dhurma[1] Rajah became the spiritual head of this sect, and, as is well known, disputes the temporal government also of his country with the Deva Rajah, who is the hereditary temporal monarch, and never claims spiritual jurisdiction. I am indebted to Dr. Campbell for a copy and translation of the Dhurma Rajah's great seal, containing the attributes of his spirituality, a copy of which I have appended to the end of this chapter.

The internal organization of the different monastic establishments is very simple. The head or Teshoo Lama[2] rules supreme; then come the monks and various orders of priests, and then those who are candidates for orders, and dependents, both lay-brothers and slaves: there are a few nunneries in Sikkim, and the nuns are all relatives or connections of the Rajah, his sister is amongst them. During the greater part of the year all lead a more or less idle life; the dependents being the most occupied in carrying wood and water, cultivating the land, &c.

The lay-brothers are often skilful workmen, and are sometimes lent or hired out as labourers, especially as house-builders and decorators. No tax of any kind is levied on the church, which is frequently very rich in land, flocks, and herds, and in contributions from the people: land is sometimes granted by the Rajah, but is oftener purchased by the priests, or willed, or given by the proprietor. The services, to which I have already alluded, are very irregularly performed; in most temples only on festival days, which correspond to the Tibetan ones so admirably described in MM. Huc and Gabet's narrative; in a few, however, service is performed daily, especially in such as stand near frequented roads, and hence reap the richest harvest.

Like all the natives of Tibet and Sikkim, the priests are intolerably filthy; in some cases so far carrying out their doctrines as not even to kill the vermin with which they swarm. All are nominally bound to chastity, but exemptions in favour of Lamas of wealth, rank, or power, are granted by the supreme pontiffs, both in Tibet and Sikkim. I constantly found swarms of children about the Lamaseries, who were invariably called nephews and nieces.

[1] Bhotan is generally known as the Dhurma country. See page 93, in note.

[2] I have been informed by letters from Dr. Campbell that the Pemiongchi Lama is about to remove the religious capital of Sikkim to Darjeeling, and build there a grand temple and monastery; this will be attractive to visitors, and afford the means of extending our knowledge of East Tibet.

Descending from the Catsuperri temples, I encamped at the village of Tengling (elevation 5,257 feet), where I was waited upon by a bevy of forty women, Lepchas and Sikkim Bhoteeas, accompanied by their children, and bringing presents of fowls, rice and vegetables, and apologising for the absence of their male relatives, who were gone to carry tribute to the Rajah. Thence I marched to Changachelling, first descending to the Tengling river, which divides the Catsuperri from the Molli ridge, and which I crossed.

Tree-ferns here advanced further north than in any other part of Sikkim. I did not visit the Molli temples, but crossed the spur of that name, to the Rungbee river, whose bed is 3,300 feet above the sea; thence I ascended upwards of 3,500 feet to the Changachelling temples, passing Tchongpong village. The ridge on which both Pemiongchi and Changachelling are built is excessively narrow at top; it is traversed by a "via sacra," connecting these two establishments; this is a pretty wooded walk, passing mendongs and chaits hoary with lichens and mosses; to the north the snows of Kinchinjunga are seen glimmering between the trunks of oaks, laurels, and rhododendrons, while to the south the Sinchul and Darjeeling spurs shut out the view of the plains of India.

Changachelling temples and chaits crown a beautiful rocky eminence on the ridge, their roofs, cones and spires peeping through groves of bamboo, rhododendrons, and arbutus; the ascent is by broad flights of steps cut in the mica-slate rocks, up which shaven and girdled monks, with rosaries and long red gowns, were dragging loads of bamboo stems, that produced a curious rattling noise. At the summit there is a fine temple, with the ruins of several others, and of many houses: the greater part of the principal temple, which is two-storied and divided into several compartments, is occupied by families. The monks were busy repairing the part devoted to worship, which consists of a large chamber and vestibule of the usual form: the outside walls are daubed red, with a pigment of burnt felspathic clay, which is dug hard by. Some were painting the vestibule with colours brought from Lhassa, where they have been trained to the art. Amongst other figures was one playing on a guitar, a very common symbol in the vestibules of Sikkim temples; I also saw an angel playing on the flute, and a snake-king offering fruit to a figure in the water, who was grasping a serpent. Amongst the figures I was struck by that of an Englishman, whom, to my amusement, and the limner's great delight, I recognized as myself. I was

depicted in a flowered silk coat instead of a tartan shooting-jacket, my shoes were turned up at the toes, and I had on spectacles and a tartar cap, and was writing notes in a book. On one side a snake king was politely handing me fruit, and on the other a horrible demon was writhing.

A crowd had collected to see whether I should recognize myself, and when I did so, the merriment was extreme. They begged me to send them a supply of vermilion, gold-leaf, and brushes; our so-called camel's-hair pencils being much superior to theirs, which are made of marmot's hair.

I was then conducted to a house, where I found salted and buttered tea and Murwa beer smoking in hospitable preparation. As usual, the house was of wood, and the inhabited apartments above the low basement story were approached by an outside ladder, like a Swiss cottage: within were two rooms floored with earth; the inner was small, and opened on a verandah that faced Kinchinjunga, whence the keen wind whistled through the apartment.

The head Lama, my jolly fat friend of the 20th of December, came to breakfast with me, followed by several children, nephews and nieces he said; but they were uncommonly like him for such a distant relationship, and he seemed extremely fond of them, and much pleased when I stuffed them with sugar.

Changachelling hill is remarkable for having on its summit an immense tabular mass of chlorite slate, resting apparently horizontally on variously inclined rocks of the same: it is quite flat-topped, ten to twelve yards each way, and the sides are squared by art; the country people attribute its presence here to a miracle.

The view of the Kinchin range from this spot being one of the finest in Sikkim, and the place itself being visible from Darjeeling, I took a very careful series of bearings, which, with those obtained at Pemiongchi, were of the utmost use in improving my map, which was gradually progressing. To my disappointment I found that neither priest nor people knew the name of a single snowy mountain. I also asked in vain for some interpretation of the lines I have quoted at p. 256; they said they were Lepcha worship, and that they only used them for the gratification of the people, on the day of the great festival of Kinchinjunga.

Hence I descended to the Kulhait river, on my route back to Darjeeling, visiting my very hospitable tippling friend, the Kajee of Lingcham, on the way down: he humbly begged me to get him a pair of spectacles, for no other object than to look wise, as

he had the eyes of a hawk; he told me that mine drew down universal respect in Sikkim, and that I had been drawn with them on, in the temple at Changachelling; and that a pair would not only wonderfully become him, but afford him the most pleasing recollections of myself. Happily I had the means of gratifying him, and have since been told that he wears them on state occasions.

I encamped by the river, 3,160 feet above the sea, amongst figs and plantains, on a broad terrace of pebbles, boulders and sand, ten feet above the stream; the rocks in the latter were covered with a red conferva. The sand on the banks was disposed in layers, alternately white and red, the white being quartz, and the red pulverised garnets. The arranging of these sand-bands by the water must be due to the different specific gravities of the garnet and quartz; the former being lighter, is lifted by the current on to the surface of the quartz, and left there when the waters retire.

On the next day I ascended Hee hill, crossed it at an elevation of 7,290 feet, and camped on the opposite side at 6,680 feet, in a dense forest. The next march was still southward to the little Rungeet guard-house, below Darjeeling spur, which I reached after a fatiguing walk amidst torrents of rain. The banks of the little Rungeet river, which is only 1,760 feet above the sea, are very flat and low, with broad terraces of pebbles and shingle, upon which are huge gneiss boulders, fully 200 feet above the stream.

On the 19th of January, I ascended the Tukvor spur to Darjeeling, and received a most hospitable welcome from my friend Mr. Muller, now almost the only European inhabitant of the place. Mr. Hodgson having gone down on a shooting excursion in the Terai, and Dr. Campbell being on duty on the Bhotan frontier, the place looked what it really was—wholly deserted. The rain I had experienced in the valley had here been snow, and the appearance of the broad snowed patches clear of trees, and of the many houses without smoke or inhabitant, and the tall scattered trees with black bark and all but naked branches, was dismal in the extreme. The effect was heightened by an occasional Hindoo, who flitted here and there along the road, crouching and shivering, with white cotton garments and bare legs.

The delight of my Lepcha attendants at finding themselves safely at home again knew no bounds; and their parents waited on me with presents, and other tokens of their goodwill and grati-

tude. I had no lack of volunteers for a similar excursion in the following season, though with their usual fickleness, more than half failed me, long before the time arrived for putting their zeal to the proof.

I am indebted to Dr. Campbell for the accompanying impression and description of the seal of the Dhurma Rajah, or sovereign pontiff of Bhotan, and spiritual head of the whole sect of the Dookpa, or red-mitred Lama Boodhists. The translations were made by Aden Tchebu Lama, who accompanied us into Sikkim in 1849, and I believe they are quite correct. The Tibetan characters run from left to right.

The seal of the Dhurma Rajah is divided into a centre portion and sixteen rays. In the centre is the word Dookyin, which means "The Dookpa Creed;" around the "Dookyin" are sixteen similar letters, meaning "I," or "I am." The sixteen radial compartment contain his titles and attributes, thus, commencing from the centre erect one, and passing round from left to right :—

1. I am the Spiritual and Temporal Chief of the Realm.
2. The Defender of the Faith.
3. Equal to Saruswati in learning.
4. Chief of all the Boodhs.
5. Head expounder of the Shasters.
6. Caster out of devils.
7. The most learned in the Holy Laws.
8. An Avatar of God (or, by God's will).
9. Absolver of sins.
10. I am above all the Lamas of the Dookpa Creed.
11. I am of the best of all Religions—the Dookpa.
12. The punisher of unbelievers.
13. Unequalled in expounding the Shasters
14. Unequalled in holiness and wisdom.
15. The head (or fountain) of all Religious Knowledge.
16. The Enemy of all false Avatars.

CHAPTER XVII.

EXCURSION TO TERAI.

Dispatch collections—Acorns—Heat—Punkabaree—Bees—Vegetation—Haze—Titalya—Earthquake—Proceed to Nepal frontier—Terai, geology of—Physical features of Himalayan valleys—Elephants, purchase of, &c.—River-beds—Mechi river—Return to Titalya—Leave for Teesta—Climate of plains—Jeelpigoree—Cooches—Alteration in the appearance of country by fires, &c.—Grasses—Bamboos—Cottages—Rajah of Coochpigoree—Condition of people—Hooli festival—Ascend Teesta—Canoes—Cranes—Forest—Baikant-pore—Rummai—Religion—Plants at foot of mountains—Exit of Teesta—Canoe voyage down to Rangmally—English genera of plants—Birds—Beautiful scenery—Botanizing on elephants—Willow—Siligoree—Cross Terai—Geology—Iron—Lohar-ghur—Coal and sandstone beds—Mechi fisherman—Hailstorm—Ascent to Khersiong—To Darjeeling—Vegetation—Geology—Folded quartz-beds—Spheres of feldspar—Lime deposits.

HAVING arranged the collections (amounting to eighty loads) made during 1848, they were conveyed by coolies to the foot of

the hills, where carts were provided to carry them five days' journey to the Mahanuddy river, which flows into the Ganges, whence they were transported by water to Calcutta.

On the 27th of February, I left Darjeeling to join Mr. Hodgson at Titalya, on the plains. The weather was raw, cold, and threatening: snow lay here and there at 7,000 feet, and all vegetation was very backward, and wore a wintry garb. The laurels, maples, and deciduous-leaved oaks, hydrangea and cherry, were leafless, but the abundance of chestnuts and evergreen oaks, rhododendrons, *Aucuba*, *Limonia*, and other shrubs, kept the forest well clothed. The oaks had borne a very unusual number of acorns during the last season, which were now falling, and strewing the road in some places so abundantly, that it was hardly safe to ride down hill.

The plains of Bengal were all but obscured by a dense haze, partly owing to a peculiar state of the atmosphere that prevails in the dry months, and partly to the fires raging in the Terai forest, from which white wreaths of smoke ascended, stretching obliquely for miles to the eastward, and filling the air with black particles of grass-stems, carried 4,000 feet aloft by the heated ascending currents that impinge against the flanks of the mountains.

In the tropical region the air was scented with the white blossoms of the *Vitex Agnus castus*, which grew in profusion by the road-side; but the forest, which had looked so gigantic on my arrival at the mountains the previous year, appeared small after the far more lofty and bulky oaks and pines of the upper regions of the Himalaya.

The evening was sultry and close, the heated surface of the earth seemed to load the surrounding atmosphere with warm vapours, and the sensation, as compared with the cool pure air of Darjeeling, was that of entering a confined tropical harbour after a long sea-voyage.

I slept in the little bungalow of Punkabaree, and was wakened next morning by sounds to which I had long been a stranger, the voices of innumerable birds, and the humming of great bees that bore large holes for their dwellings in the beams and rafters of houses: never before had I been so forcibly struck with the absence of animal life in the regions of the upper Himalaya.

Breakfasting early, I pursued my way in the so-called cool of the morning; but this was neither bright nor fresh; the night having been hazy, there had been no terrestrial radiation, and the earth was dusty and parched; while the sun rose through a murky yellowish atmosphere with ill-defined orb. Thick clouds

of smoke pressed upon the plains, and the faint easterly wind wafted large flakes of grass charcoal sluggishly through the air.

Vegetation was in great beauty, though past its winter prime. The tropical forest of India has two flowering seasons; one in summer, of the majority of plants; and the other in winter, of *Acanthaceæ*, *Bauhinia*, *Dillenia*, *Bombax*, &c. Of these the former are abundant, and render the jungle gay with large and delicate white, red, and purple blossoms. Coarse, ill-favoured vultures wheeled through the air, languid Bengalees had replaced the active mountaineers, jackal-like curs of low degree teemed at every village, and ran howling away from the onslaught of my mountain dog; and the tropics, with all their beauty of flower and genial warmth, looked as forbidding and unwholesome as they felt oppressive to a frame that had so long breathed the fresh mountain air.

Mounted on a stout pony, I enjoyed my scamper of sixteen miles over the wooded plains and undulating gravelly slopes of the Terai, intervening between the foot of the mountains and Siligoree bungalow, where I rested for an hour. In the afternoon I rode on leisurely to Titalya, sixteen miles further, along the banks of the Mahanuddy, the atmosphere being so densely hazy, that objects a few miles off were invisible, and the sun quite concealed, though its light was so powerful that no part of the sky could be steadily gazed upon. This state of the air is very curious, and has met with various attempts at explanation,[1] all unsatisfactory to me; it accompanies great heat, dryness, and elasticity of the suspended vapours, and is not affected by wind. During the afternoon the latter blew with violence, but being hot and dry, brought no relief to my still unacclimated frame. My pony alone enjoyed the freedom of the boundless plains, and the gallop or trot being fatiguing in the heat, I tried in vain to keep him at a walk; his spirits did not last long, however, for he flagged after a few days' tropical heat. My little dog had run thirty miles the day before, exclusive of all

[1] Dr. M'Lelland ("Calcutta Journal of Natural History," vol. i., p. 52), attributes the haze of the atmosphere during the north-west winds of this season, wholly to suspended earthy particles. But the haze is present even in the calmest weather, and extreme dryness is in all parts of the world usually accompanied by an obscure horizon. Captain Campbell ("Calcutta Journal of Natural History," vol. ii., p. 44) also objects to Dr. M'Clelland's theory, citing those parts of Southern India which are least likely to be visited by dust-storms as possessing an equally hazy atmosphere; and further denies its being influenced by the hygrometric state of the atmosphere.

the detours he had made for his own enjoyment, and he flagged so much after twenty more this day, that I had to take him on my saddle-bow, where, after licking his hot swollen feet, he fell asleep, in spite of the motion

After leaving the wooded Terai at Siligoree, trees became scarce, and clumps of bamboos were the prevalent features; these, with an occasional banyan, peepul, or betel-nut palm near the villages, were the only breaks on the distant horizon. A powerfully scented *Clerodendron*, and an *Osbeckia* gay with blossoms like dog-roses, were abundant; the former especially under trees, where the seeds are dropped by birds.

At Titalya bungalow I received a hearty welcome from Mr. Hodgson, and congratulations on the success of my Nepal journey, which afforded a theme for many conversations.

In the evening we had three sharp jerking shocks of an earthquake in quick succession, at 9.8 P.M., appearing to come up from the southward: they were accompanied by a hollow rumbling sound like that of a waggon passing over a wooden bridge. The shock was felt strongly at Darjeeling, and registered by Mr. Muller at 9.10 P.M.: we had accurately adjusted our watches (chronometers) the previous morning, and the motion may therefore fairly be assumed to have been transmitted northwards through the intervening distance of forty miles in two minutes. Both Mr. Muller and Mr. Hodgson had noted a much more severe shock at 6.10 P.M. the previous evening, which I, who was walking down the mountain, did not experience; this caused a good deal of damage at Darjeeling, in cracking well-built walls. Earthquakes are frequent all along the Himalaya, and are felt far in Tibet; they are, however, most common towards the eastern and western extremities of India; owing in the former case to the proximity of the volcanic forces in the bay of Bengal. Cutch and Scinde, as is well known, have suffered severely on many occasions, and in several of them the motion has been propagated through Affghanistan and Little Tibet, to the heart of Central Asia.[1]

On the morning of the 1st of March, Dr. Campbell arrived at the bungalow, from his tour of inspection along the frontier of Bhotan and the Rungpore district; and we accompanied him hence along the British and Sikkim frontier, as far west as the Mechi river, which bounds Nepal on the east.

Terai is a name loosely applied to a tract of country at the

[1] See "Wood's Travels to the Oxus."

very foot of the Himalya: it is Persian, and signifies damp. Politically, the Terai generally belongs to the hill-states beyond it; geographically, it should appertain to the plains of India; and geologically, it is a sort of neutral country, being composed neither of the alluvium of the plains, nor of the rocks of the hills, but for the most part of alternating beds of sand, gravel, and boulders brought from the mountains. Botanically, it is readily defined as the region of forest-trees; amongst which the Sal, the most valuable of Indian timber, is conspicuous in most parts, though not now in Sikkim, where it has been destroyed. The Terai soil is generally light, dry, and gravelly (such as the Sal always prefers), and varies in breadth, from ten miles along the Sikkim frontier, to thirty and more on the Nepalese. In the latter country it is called the Morung, and supplies Sal and Sissoo timber for the Calcutta market, the logs being floated down the Konki and Cosi rivers to the Ganges. The gravel-beds extend uninterruptedly upon the plains for fully twenty miles south of the Sikkim mountains, the gravel becoming smaller as the distance increases, and large blocks of stone not being found beyond a few miles from the rocks of the Himalaya itself, even in the beds of rivers, however large and rapid. Throughout its breadth this formation is conspicuously cut into flat-topped terraces, flanking the spurs of the mountains, at elevations varying from 250 to nearly 1,000 feet above the sea. These terraces are of various breadth and length, the smallest lying uppermost, and the broadest flanking the rivers below. The isolated hills beyond are also flat-topped and terraced. This deposit contains no fossils; and its general appearance and mineral constituents are the only evidence of its origin, which is no doubt due to a retiring ocean that washed the base of the Sikkim Himalaya, received the contents of its rivers, and, wearing away its bluff spurs, spread a talus upwards of 1,000 feet thick along its shores. It is not at first sight evident whether the terracing is due to periodic retirements of the ocean, or to the levelling effects of rivers that have cut channels through the deposit. In many places, especially along the banks of the great streams, the gravel is smaller, obscurely interstratified with sand, and the flattened pebbles over-lap rudely, in a manner characteristic of the effects of running water; but such is not the case with the main body of the deposit, which is unstratified, and much coarser.

The alluvium of the Gangetic valley is both interstratified with the gravel, and passes into it; and was no doubt deposited in deep

water, whilst the coarser matter[1] was accumulating at the foot of the mountains.

This view is self-evident, and nas occurred, I believe, to almost every observer, at whatever part of the base of the Himalaya he may have studied this deposit. Its position, above the sandstones of the Sewalik range in the north-west Himalaya, and those of Sikkim, which appear to be modern fossiliferous rocks, indicates its being geologically of recent formation; but it still remains a subject of the utmost importance to discover the extent and nature of the ocean to whose agency it is referred. I have elsewhere remarked that the alluvium of the Gangetic valley may to a great degree be the measure of the denudation which the Himalaya has suffered along its Indian watershed. It was, no doubt, during the gradual rise of that chain from the ocean, that the gravel and alluvium were deposited; and in the terraces and alternation of these there is evidence that there have been many subsidences and elevations of the coast-line, during which the gravel has suffered greatly from denudation.

I have never looked at the Sikkim Himalaya from the plains without comparing its bold spurs enclosing sinuous river gorges, to the weather-beaten front of a mountainous coast; and in following any of its great rivers, the scenery of its deep valleys no less strikingly resembles that of such narrow arms of the sea (or fiords) as characterize every mountainous coast, of whatever geological formation: such as the west coast of Scotland and Norway, of South Chili and Fuegia, of New Zealand and Tasmania. There are, too, in these Himalayan valleys, at all elevations below 6,000 feet, terraced pebble-beds, rising in some cases eighty feet above the rivers, which I believe could only have been deposited by them when they debouched into deep water; and both these, and the beds of the rivers, are strewed, down to 1,000 feet, with masses of rock. Such accumulations and transported blocks are seen on the raised beaches of our narrow Scottish salt-water lochs, exposed by the rising of the land, and they are yet forming of immense thickness on many coasts by the joint action of tides and streams.

[1] This, too, is non-fossiliferous, and is of unknown depth, except at Calcutta, where the sand and clay beds have been bored through, to the depth of 120 feet, below which the first pebbles were met with. Whence these pebbles were derived is a curious problem. The great Himalayan rivers convey pebbles but a very few miles from the mountains on to the plains of India; and there is no rock *in situ* above the surface, within many miles of Calcutta, in any direction.

I have described meeting with ancient moraines in every Himalayan valley I ascended, or at about 7,000 or 8,000 feet elevation, proving, that at one period, the glaciers descended fully so much below the position they now occupy: this can only be explained by a change of climate,[1] or by a depression of the mountain mass, equal to 8,000 feet, since the formation of these moraines.

The country about Titalya looks desert, from that want of trees and cultivation, so characteristic of the upper level throughout this part of the plains, which is covered with short, poor pasture-grass. The bungalow stands close to the Mahanuddy, on a low hill, cut into an escarpment twenty feet high, which exposes a section of river-laid sand and gravel, alternating with thick beds of rounded pebbles.

Shortly after Dr. Campbell's arrival, the meadows about the bungalow presented a singular appearance, being dotted over with elephants, brought for purchase by Government. It was curious to watch the arrival of these enormous animals, which were visible nearly two miles across the flat plains; nor less interesting was it to observe the wonderful docility of these giants of the animal kingdom, often only guided by naked boys, perched on their necks, scolding, swearing, and enforcing their orders with the iron goad. There appeared as many tricks in elephant-dealers as in horse-jockeys, and of many animals brought but few were purchased. Government limits the price to about £75, and the height to the shoulder must not be under seven feet, which, incredible as it appears, may be estimated within a fraction as being three times the circumference of the forefoot. The pedigree is closely inquired into, the hoofs are examined for cracks, the teeth for age, and many other points attended to.

The Sikkim frontier, from the Mahanuddy westward to the Mechi, is marked out by a row of tall posts. The country is undulating; and though fully 400 miles from the ocean, and not

[1] Such a change of temperature, without any depression or elevation of the mountains, has been thought by Capt. R. Strachey ("Journal of Geological Society"), an able Himalayan observer, to be the necessary consequence of an ocean at the foot of these mountains; for the amount of perpetual snow, and consequent descent of the glaciers, increasing indirectly in proportion to the humidity of the climate and the snow-fall, he conjectured that the proximity of the ocean would prodigiously increase such a deposition of snow.—To me, this argument appears inconclusive; for the first effect of such a vast body of water would be to raise the temperature of winter; and as it is the rain, rather than the sun of summer, which removes the Sikkim snow, so would an increase of this rain elevate, rather than depress, the level of perpetual snow.

sixty from the top of the loftiest mountain on the globe, its average level is not 300 feet above that of the sea. The upper levels are gravelly, and loosely covered with scattered thorny jujube bushes, occasionally tenanted by the *Florican*, a kind of bustard, which scours these downs. Sometimes a solitary fig, or a thorny acacia, breaks the horizon, and there are a few gnarled trees of the scarlet *Butea frondosa*.

On our route I had a good opportunity of examining the line of junction between the alluvial plains that stretch south to the Ganges, and the gravel deposit flanking the hills. The rivers always cut broad channels with scarped terraced sides, and their low banks are very fertile, from the mud annually spread by the ever-shifting streams that meander within their limits; there are, however, few shrubs and no trees. The houses, which are very few and scattered, are built on the gravelly soil above, the lower level being very malarious.

Thirty miles south of the mountains, numerous isolated flat-topped hills, formed of stratified gravel and sand with large water-worn pebbles, rise from 80 to 200 feet above the mean level, which is about 250 feet above the sea; these, too, have always scarped sides, and the channels of small streams completely encircle them.

At this season few insects but grasshoppers are to be seen, even mosquitos being rare. Birds, however, abound, and we noticed the common sparrow, hoopoe, water-wagtail, skylark, osprey, and several egrets.

We arrived on the third day at the Mechi river, to the west of which the Nepal Terai (or Morung) begins, whose belt of Sal forest loomed on the horizon, so raised by refraction as to be visible as a dark line from the distance of many miles. It is, however, very poor, all the large trees having been removed. We rode for several miles into it, and found the soil dry and hard, but supporting a prodigious undergrowth of gigantic harsh grasses that reached to our heads, though we were mounted on elephants. Besides Sal there was abundance of *Butea*, *Diospyros*, *Terminalia*, and *Symplocos*, with the dwarf *Phœnix* palm, and occasionally *Cycas*. Tigers, wild elephants, and the rhinoceros, are said to be found here: but we saw none.

The old and new Mechi rivers are several miles apart, but flow in the same depression, a low swamp many miles broad, which is grazed at this season and cultivated during the rains. The grass is very rich, partly owing to the moisture of the climate, and partly to the retiring waters of the rivers; both circumstances

being the effects of proximity to the Himalaya. Hence cattle (buffalos and the common humped cow of India) are driven from the banks of the Ganges 300 miles to these feeding grounds, for the use of which a trifling tax is levied on each animal. The cattle are very carelessly herded, and many are carried off by tigers.

Having returned to Titalya, Mr. Hodgson and I set off in an eastern direction for the Teesta river, whose embouchure from the mountains to the plains I was anxious to visit. Though the weather is hot, and oppressively so in the middle of the day, there are few climates more delicious than that of these grassy savannahs from December to March. We all started soon after daybreak on ponies, and enjoyed a twelve to sixteen miles' gallop in the cool of the morning before breakfast, which we found prepared on our arrival at a tent sent on ahead the night before. The road led across an open country, or followed paths through interminable rice-fields, now dry and dusty. On poor soil a white-flowered *Leucas* monopolized the space, like our charlock and poppy; it was apparently a pest to the agriculturist, covering the surface in some places like a sprinkling of snow. Sometimes the river-beds exposed fourteen feet of pure stratified sand, with only an inch of vegetable soil above.

At this season the mornings are very hazy, with the thermometer at sunrise 60°; one laid on grass during the night falling 7° below that temperature: dew forms, but never copiously; by 10 A.M. the temperature has risen to 75°, and the faint easterly morning breezes die away; the haze thickens, and covers the sky with a white veil, the thermometer rising to 82° at noon, and the west wind succeeding in parching tornados and furious gusts, increasing with the temperature, which attains its maximum in the afternoon, and falling again with its decline at sunset. The evenings are calm; but the earth is so heated, that the thermometer stands at 10 P.M. at 66°, and the minimum at night is not below 55°. Great drought accompanies the heat at this season, but not to such a degree as in North-west India, or other parts of this meridian further removed from the hills. In the month of March, and during the prevalence of west winds, the mean temperature was 79°, and the dew-point 22° lower, indicating great drought. The temperature at Calcutta was 7° degrees warmer, and the atmosphere very much damper.

On the second day we arrived at Jeelpigoree, a large straggling village near the banks of the Teesta, a good way south of the forest: here we were detained for several days, waiting for

elephants with which to proceed northwards. The natives are Cooches, a Mogul (Mongolian) race, who inhabit the open country of this district, replacing the Mechis of the Terai forest. They are a fine athletic people, not very dark, and formed the once-powerful house of Coochpigoree. Latterly the upper classes have adopted the religion of the Brahmins, and have had caste conferred upon them; while the lower orders have turned Mahomedans: these, chiefly agriculturists, are a timid, oppressed class, who everywhere fled before us, and were with difficulty prevailed upon even to direct us along our road. A rude police is established by the British Government all over the country, and to it the traveller applies for guides and assistance; but the Cooches were so shy and difficult to deal with, that we were generally left to our own resources.

Grass is the prevailing feature of the country, as there are few shrubs, and still fewer trees. Goats and the common Indian cow are plentiful; but it is not swampy enough for the buffalo; and sheep are scarce, on account of the heat of the climate. This uniformity of feature over so immense an area is, however, due to the agency of man, and is of recent introduction; as all concur in affirming, that within the last hundred years the face of the country was covered with the same long jungle-grasses which abound in the Terai forest; and the troops cantoned at Titalya (a central position in these plains) from 1816 to 1828, confirm this statement as far as their immediate neighbourhood is concerned.

These gigantic *Gramineæ* seem to be destroyed by fire with remarkable facility at one season of the year; and it is well that this is the case; for, whether as a retainer of miasma, a shelter for wild beasts, both carnivorous and herbivorous, alike dangerous to man, or from their liability to ignite, and spread destruction far and wide, the grass-jungles are most serious obstacles to civilization. Next to the rapidity with which it can be cleared, the adaptation of a great part of the soil to irrigation during the rains has greatly aided the bringing of it under cultivation.

By far the greater proportion of this universal short turf grass is formed of *Andropogon aciculatis*, *Cynodon Dactylon*,[1] and in sandy places, *Imperata cylindrica;* where the soil is wetter, *Ameletia Indica* is abundant, giving a heather-like colour to the turf, with its pale purple flowers; wherever there is standing water, its surface is reddened by the *Azolla*, and *Salvinia* is also common.

[1] Called "Dhob." This is the best pasture grass in the plains of India, and the only one to be found over many thousands of square miles.

At Jeelpigoree we were waited upon by the Dewan, who governs the district for the Rajah. The latter is a boy about ten years old, whose estates are locked up during the trial of an interminable suit for the succession, that has been instituted against him by a natural son of the late Rajah. We found the Dewan to be a man of intelligence, who promised us elephants as soon as the great Hooli festival, now commenced, should be over.

The large village, at the time of our visit, was gay with holiday dresses. It is surrounded by trees, chiefly of banyan, jack, mango, peepul, and tamarind; interminable rice-fields extend on all sides, and except bananas, slender betel-nut palms, and sometimes pawn, or betel-pepper, there is little other extensive cultivation. The rose-apple, orange, and pine-apple are rare, as are cocoa-nuts; there are few date or fan-palms, and only occasionally poor crops of castor-oil and sugar-cane. In the gardens I noticed jasmine, *Justicia Adhatoda*, *Hibiscus*, and others of the very commonest Indian ornamental plants; while for food were cultivated *Chenopodium*, yams, sweet potatoes, and more rarely peas, beans, and gourds. Bamboos were planted round the little properties and smaller clusters of houses, in oblong squares, the ridge on which the plants grew being usually bounded by a shallow ditch. The species selected was not the most graceful of its family; the stems, or culms, being densely crowded, erect, as thick at the base as the arm, copiously branching, and very feathery throughout their whole length of sixty feet.

A gay-flowered *Osbeckia* was common along the roadsides, and, with a *Clerodendron*,[1] whose strong, sweet odour was borne far through the air, formed a low undershrub beneath every tree, generally intermixed with three ferns (a *Polypodium*, *Pteris*, and *Goniopteris*).

The cottages are remarkable, and have a very neat appearance, presenting nothing but a low white-washed platform of clay, and an enormous high, narrow, black, neatly-thatched roof, so arched along the ridge, that its eaves nearly touch the ground at each gable; and looking at a distance like a gigantic round-backed elephant. The walls are of neatly-platted bamboo: each window (of which there are two) is crossed by slips of bamboo, and wants

[1] *Clerodendron* leaves, bruised, are used to kill vermin, fly-blows, &c., in cattle; and the twigs form toothpicks. The flowers are presented to Mahadeo, as a god of peace; milk, honey, flowers, fruit, amrit (ambrosia), &c., being offered to the pacific gods, as Vishnu, Krishna, &c.; while Mudar (*Asclepias*), Bhang (*Cannabis sativa*), *Datura*, flesh, blood, and spirituous liquors, are offered to Siva, Doorga, Kali, and other demoniacal deities.

only glass to make it look European; they have besides shutters of wattle, that open upwards, projecting during the day like the port-hatches of a ship, and let down at night. Within, the rooms are airy and clean: one end contains the machans (bedsteads), the others some raised clay benches, the fire, frequently an enormous Hookah, round wattled stools, and various implements. The inhabitants appeared more than ordinarily well-dressed; the men in loose flowing robes of fine cotton or muslin, the women in the usual garb of a simple thick cotton cloth, drawn tight immediately above the breast, and thence falling perpendicularly to the knee; the colour of this is a bright blue in stripes, bordered above and below with red.

I anticipated some novelty from a visit to a Durbar (court) so distant from European influence as that of the Rajah of Jeelpigoree. All Eastern courts, subject to the Company, are, however, now shorn of much of their glory; and the condition of the upper classes is greatly changed. Under the Mogul rule, the country was farmed out to Zemindars, some of whom assumed the title of Rajah: they collected the revenue for the Sovereign, retaining by law ten per cent. on all that was realized; there was no intermediate class, the peasant paying directly to the Zemindar, and he into the royal treasury. Latterly the Zemindars have become farmers under the Company's rule; and in the adjudication of their claims, Lord Cornwallis (then Governor-General) made great sacrifices in their favour, levying only a small tribute in proportion to their often great revenues, in the hope that they would be induced to devote their energies, and some of their means, to the improvement of the condition of the peasantry. This expectation was not realized; the younger Zemindars especially, subject to no restraint (except from aggressions on their neighbours), fell into slothful habits, and the collecting of the revenue became a trading speculation, entrusted to "middle men." The Zemindar selects a number, who again are at liberty to collect through the medium of several sub-renting classes. Hence the peasant suffers, and except a generally futile appeal to the Rajah, he has no redress. The law secures him tenure as long as he can pay his rent, and to do this he has recourse to the usurer; borrowing in spring (at 50, and oftener 100 per cent.) the seed, plough, and bullocks; he reaps in autumn, and what is then not required for his own use, is sold to pay off part of his original debt, the rest standing over till the next season; and thus it continues to accumulate, till, overwhelmed with difficulties, he is ejected, or flees to a neighbouring district. The Zemindar

enjoys the same right of tenure as the peasant: the amount of impost laid on his property was fixed for perpetuity; whatever his revenue be, he must pay so much to the Company, or he forfeits his estates, and they are put up for auction.

One evening we visited the young Rajah at his residence, which has rather a good appearance at a distance, its white walls gleaming through a dark tope of mango, betel, and cocoa-nut. A short rude avenue leads to the entrance gate, under the trees of which a large bazaar was being held; stocked with cloths, simple utensils, ornaments, sweetmeats, five species of fish from the Teesta, and the betel-nut.

We entered through a guard-house, where were some of the Rajah's sepoys in the European costume, and a few of the Company's troops, lent to the Rajah as a security against some of the turbulent pretenders to his title. Within was a large court-yard, flanked by a range of buildings, some of good stone-work, some of wattle, in all stages of disrepair. A great crowd of people occupied one end of the court, and at the other we were received by the Dewan, and seated on chairs under a canopy supported by slender silvered columns. Some slovenly Natch-girls were dancing before us, kicking up clouds of dust, and singing or rather bawling through their noses, the usual indelicate hymns in honour of the Hooli festival; there were also fiddlers, cutting uncouth capers in rhythm with the dancers. Anything more deplorable than the music, dancing, and accompaniments cannot well be imagined; yet the people seemed vastly pleased, and extolled the performers.

The arrival of the Rajah and his brothers was announced by a crash of tom-toms and trumpets, while over their heads were carried great gilt canopies. With them came a troop of relations, of all ages; and amongst them a poor little black girl, dressed in honour of us in an old-fashioned English chintz frock and muslin cap, in which she cut the drollest figure imaginable; she was carried about for our admiration, like a huge Dutch doll, crying lustily all the time.

The festivities of the evening commenced by handing round trays full of pith-balls, the size of a nutmeg, filled with a mixture of flour, sand, and red lac-powder; with these each pelted his neighbour, the thin covering bursting as it struck any object, and powdering it copiously with red dust. A more childish and disagreeable sport cannot well be conceived; and when the balls were expended, the dust itself was resorted to, not only fresh, but that which had already been used, was gathered up, with whatever

dirt it might have become mixed. One rude fellow, with his hand full, sought to entrap his victims into talking, when he would stuff the nasty mixture into their mouths.

At the end attar of roses was brought, into which little pieces of cotton, fixed on slips of bamboo, were dipped, and given to each person. The heat, dust, stench of the unwashed multitude, noise, and increasing familiarity of the lower orders, warned us to retire, and we effected our retreat with precipitancy.

The Rajah and his brother were very fine boys, lively, frank, unaffected, and well disposed: they have evidently a good guide in the old Dewan; but it is melancholy to think how surely, should they grow up in possession of their present rank, they will lapse into slothful habits, and take their place amongst the imbeciles who now represent the once powerful Rajahs of Bengal.

We rode back to our tents by a bright moonlight, very dusty and tired, and heartily glad to breathe the cool fresh air, after the stifling ordeal we had undergone.

On the following evening the elephants were again in waiting to conduct us to the Rajah. He and his relations were assembled outside the gates, mounted upon elephants, amid a vast concourse of people. The children and Dewan were seated in a sort of cradle; the rest were some in howdahs, and some astride on elephants' backs, six or eight together. All the idols were paraded before them, and powdered with red dust; the people howling, shouting, and sometimes quarrelling. Our elephants took their places amongst those of the Rajah; and when the mob had sufficiently pelted one another with balls and dirty red powder, a torchlight procession was formed, the idols leading the way, to a very large tank, bounded by a high rampart, within which was a broad esplanade round the water.

The effect of the whole was very striking, the glittering cars and barbaric gaud of the idols showing best by torchlight; while the white robes and turbans of the undulating sea of people, and the great black elephants picking their way with matchless care and consideration, contrasted strongly with the quiet moonbeams sleeping on the still broad waters of the tank.

Thence the procession moved to a field, where the idols were placed on the ground, and all dismounted; the Dewan then took the children by the hand, and each worshipped his tutelary deity in a short prayer dictated by the attendant Brahmin, and threw a handful of red dust in its face. After another ordeal of powder, singing, dancing, and suffocation, our share in the Hooli ended; and having been promised elephants for the following morning,

we bade a cordial farewell to our engaging little hosts and their staid old governor.

On the 10th of March we were awakened at an early hour by a heavy thunder-storm from the south-west. The sunrise was very fine, through an arch 10° high of bright blue sky, above which the whole firmament was mottled with cirrus. It continued cloudy, with light winds, throughout the day, but clear on the horizon. From this time such storms became frequent, ushering in the equinox; and the less hazy sky and rising hygrometer predicted an accession of moisture in the atmosphere.

We left for Rangamally, a village eight miles distant in a northerly direction, our course lying along the west bank of the Teesta.

The river is here navigated by canoes, thirty to forty feet long, some being rudely cut out of a solid log of Sal, while others are built, the planks, of which there are but few, being sewed together, or clamped with iron, and the seams caulked with the fibres of the root of Dhak (*Butea frondosa*), and afterwards smeared with the gluten of *Diospyros embryopteris*. The bed of the river is here three-quarters of a mile across, of which the stream does not occupy one-third; its banks are sand-cliffs, fourteen feet in height. A few small fish and water-snakes swarm in the pools. The whole country improved in fertility as we advanced towards the mountains; the grass became greener, and more trees, shrubs, herbs, and birds appeared. In front, the dark boundary-line of the Sal forest loomed on the horizon, and to the east rose the low hills of Bhotan, both backed by the outer ranges of the Himalaya.

Flocks of cranes were abundant over-head, flying in wedges, or breaking up into "open order," preparing for their migration northwards, which takes place in April, their return occuring in October; a small quail was also common on the ground. Tamarisk ("Jhow") grew in the sandy bed of the river; its flexible young branches are used in various parts of India for wattling and basket-making.

In the evening we walked to the skirts of the Sal forest. The great trunks of the trees were often scored by tigers' claws, this animal indulging in the cat-like propensity of rising and stretching itself against such objects. Two species of *Dillenia* were common in the forest, with long grass, *Symplocos*, *Emblica*, and *Cassia Fistula*, now covered with long pods. Several parasitical air-plants grew on the dry trees, as *Oberonia*, *Vanda*, and *Ærides*.

At Rangamally, the height of the sandy banks of the Teesta

varies from fifteen to twenty feet. The bed is a mile across, and all sand ;[1] the current much divided, and opaque green, from the glacial origin of most of its head-streams. The west bank was covered with a small Sal forest, mixed with *Acacia Catechu*, and brushwood, growing in a poor vegetable loam, over very dry sand.

The opposite (or Bhotan) bank is much lower, and always flooded during the rains, which is not the case on the western side, where the water rises to ten feet below the top of the bank, or from seven to ten feet above its height in the dry season, and it then fills its whole bed. This information we had from a police Jemadar, who has resided many years on this unhealthy spot, and annually suffers from fever. The Sal forest has been enroached upon from the south, for many miles, within the memory of man, by clearing in patches, and by indiscriminate felling.

About ten miles nortn of Rangamally, we came to an extensive flat, occupying a recess in the high west bank, the site of the old capital (Bai-kant-pore) of the Jeelpigoree Rajah. Hemmed in as it is on three sides by a dense forest, and on all by many miles of malarious Terai, it appears sufficiently secure from ordinary enemies during a great part of the year. The soil is sandy, overlying gravel, and covered with a thick stratum of fine mud or silt, which is only deposited on these low flats; on it grew many naturalized plants, as hemp, tobacco, jack, mango, plantain, and orange.

About eight miles on we left the river-bed, and struck westerly through a dense forest, to a swampy clearance occupied by the village of Rummai, which appeared thoroughly malarious; and we pitched the tent on a narrow, low ridge, above the level of the plain.

It was now cool and pleasant, partly due, no doubt, to a difference in the vegetation, and the proximity of swamp and forest, and partly also to a change in the weather, which was cloudy and threatening; much rain, too, had fallen here on the preceding day.

Brahmins and priests of all kinds are few in this miserable country. Near the villages, and under the large trees, are, every here and there, a few miniature thatched cottages, four to six feet high, in which the tutelary deities of the place are kept; they are idols of the very rudest description, of Vishnu as an ascetic (Bai kant Nath), a wooden doll, gilt and painted, standing, with the hands raised as if in exhortation, and one leg crossed over the

[1] Now covered with *Anthistiria* grass, fifteen feet high, a little *Sissoo*, and *Bombax*.

other. Again, Kartik, the god of war, is represented sitting astride on a peacock, with the right hand elevated and holding a small flat cup.

Some fine muscular Cooches were here brought for Mr. Hodgson's examination, but we found them unable or unwilling to converse in the Cooch tongue, which appears to be fast giving place to Bengalee.

We walked to a stream, which flows at the base of the retiring sand-cliffs, and nourishes a dense and richly-varied jungle, producing many plants, as beautiful *Acanthaceæ*, Indian horse-chestnut, loaded with white racèmes of flowers, gay *Convolvuli*, laurels, terrestrial, and parasitic *Orchideæ*, *Dillenia*, casting its enormous flowers as big as two fists, pepper, figs, and, in strange association with these, a hawthorn, and the yellow-flowered Indian strawberry, which ascends 7,500 feet on the mountains, and *Hodgsonia*, a new *Cucurbitaceous* genus, clinging in profusion to the trees, and also found 5,000 feet high on the mountains.

In the evening we rode into the forest (which was dry and very unproductive), and thence along the river-banks, through *Acacia Catechu*, belted by *Sissoo*, which often fringes the stream, always occupying the lowest flats. The foliage at this season is brilliantly green; and as the evening advanced, a yellow convolvulus burst into flower like magic, adorning the bushes over which it climbed.

It rained on the following morning; after which we left for the exit of the Teesta, proceeding northwards, sometimes through a dense forest of Sal timber, sometimes dipping into marshy depressions, or riding through grassy savannahs, breast-high. The coolness of the atmosphere was delicious, and the beauty of the jungle seemed to increase the further we penetrated these primæval forests.

Eight miles from Rummai we came on a small river from the mountains, with a Cooch village close by, inhabited during the dry season by timber-cutters from Jeelpigoree. It is situated upon a very rich black soil, covered with *Saccharum* and various gigantic grasses, but no bamboo. These long grasses replace the Sal, of which we did not see one good tree.

We here mounted the elephants, and proceeded several miles through the prairie, till we again struck upon the high Sal forest-bank, continuous with that of Rummai and Rangamally, but much loftier; it formed one of many terraces which stretch along the foot of the hills, from Punkabaree to the Teesta, but of which none are said to occur for eight miles eastwards along the

Bhotan Dooars. If true, this is probably due in part to the alteration of the course of the Teesta, which is gradually working to the westward, and cutting away these lofty banks.

The elephant-drivers appeared to have taken us by mistake to the exit of the Chawa, a small stream which joins the Teesta further to the eastward. The descent to the bed of this rivulet, round the first spur of rock we met with, was fully eighty feet, through a very irregular depression, probably the old bed of the stream; it runs southwards from the hills, and was covered from top to bottom with slate-pebbles. We followed the river to its junction with the Teesta, along a flat, broad gulley, bounded by densely-wooded, steep banks of clay-slate on the north, and the lofty bank on the south; between these the bed was strewed with great boulders of gneiss and other rocks, luxuriantly clothed with long grass, and trees of wild plantain, *Erythrina* and *Bauhinia*, the latter gorgeously in flower.

The Sal bank formed a very fine object; it was quite perpendicular, and beautifully stratified with various coloured sands and gravel; it tailed off abruptly at the junction of the rivers, and then trended away south-west, forming the west bank of the Teesta. The latter river is at its outlet a broad and rapid, but hardly impetuous stream, now fifty yards across, gushing from between two low, forest clad spurs: it appeared about five feet deep, and was beautifully fringed on both sides with green *Sissoo*.

Some canoes were here waiting for us, formed of hollowed trunks of trees, thirty feet long; two were lashed together with bamboos, and the boatmen sat one at the head and one at the stern of each: we lay along the bottom of the vessels, and in a second we were darting down the river at the rate of at least ten or fifteen miles an hour, the bright waters leaping up on all sides, and bounding in *jets-d'eau* between prows and sterns of the coupled vessels. Sometimes we glided along without perceptible motion, and at others jolted down bubbling rapids the steersmen straining every nerve to keep their bark's head to the current, as she impatiently swerved from side to side in the eddies. To our jaded and parched frames, after the hot forenoon's ride on the elephants, the effect was delicious: the fresh breeze blew on our heated foreheads and down our open throats and chests; we dipped our hands into the clear, cool stream, and there was "music in the waters" to our ears. Fresh verdure on the banks, clear pebbles, soft sand, long English river-reaches, forest glades, and deep jungles, followed in rapid succession; and as often as we rounded a bend or shot a rapid, the scene changed from bright

to brighter still; so continuing until dusk, when we were slowly paddling along the then torpid current opposite Rangamally.[1]

The absence of large stones or boulders of rock in the bed of the Teesta is very remarkable, considering the great volume and rapidity of the current, and that it shoots directly from the rocky hills to the gravelly plains. At the *embouchure* there are boulders as big as the head, and in the stream, four miles below the exit, the boatmen pointed out a stone as large as the body as quite a marvel.

They assured us that the average rise at the mouth of the river, in the rains, was not more than five feet; the mean breadth of the stream is from seventy to ninety yards. From the point where it leaves the mountains, to its junction with the Megna, is at this season thirteen days' voyage, the return occupying from twenty to twenty-five days, with the boats unladen. The name "Teesta" signifies "quiet," this river being so in comparison with other Himalayan torrents further west, the Cosi, Konki, &c., which are devastators of all that bounds their course.

We passed but two crossing-places: at one the river is divided by an island, covered with the rude chaits and flags of the Boodhists. We also saw some Cooch fishermen, who throw the net much as we do: a fine "Mahaser" (a very large carp) was the best fish they had. Of cultivation there was very little, and the only habitations were a few grass-huts of the boatmen or buffalo herdsmen, a rare Cooch village of Catechu and Sal cutters, or the shelter of timber-floaters, who seem to pass the night in nests of long dry grass.

Our servants not having returned with the elephants from Rummai, we spent the following day at Rangamally shooting and botanizing. I collected about 100 species in a couple of hours, and observed perhaps twice that number: the more common I

[1] The following temperatures of the waters of the Teesta were taken at intervals during our passage from its exit to Rangamally, a distance of fifteen linear miles, and thirty miles following the bends:—

	Water.	Air.
Exit 2h. 30m. P.M.	62°	
3	62° 2	74°.
3 30	63° 2	
4	64°	
4 30	65°	
5	65° 4	72° 5 opposite Rummai.
5 30	66°	
6	66°	71° 7 opposite Baikant.

have repeatedly alluded to, and excepting some small terrestrial *Orchids*, I added nothing of particular interest to my collection.[1]

On the 14th of March we proceeded west to Siligoree, along the skirts of the ragged Sal forest. Birds are certainly the most conspicuous branch of the natural history of this country, and we saw many species, interesting either from their habits, beauty, or extensive distribution. We noticed no less than sixteen kinds of swimming birds, several of which are migratory and English. The Shoveller, white-eyed and common wild ducks; Merganser, Brahminee, and Indian goose (*Anser Indica*); common and Gargany teal; two kinds of gull; one of Shearwater (*Rhynchops ablacus*); three of tern, and one of cormorant. Besides these there were three egrets, the large crane, stork, green heron, and the demoiselle; the English sand-martin, kingfisher, peregrine-falcon, sparrow-hawk, kestrel, and the European vulture; the wild peacock, and jungle-fowl. There were at least 100 peculiarly Indian birds in addition, of which the more remarkable were several kinds of mina, of starling, vulture, kingfisher, magpie, quail, and lapwing.

The country gradually became quite beautiful, much undulated and diversified by bright green meadows, sloping lawns, and deeply-wooded nullahs, which lead from the Sal forest and meander through this varied landscape. More beautiful sites for fine mansions could not well be, and it is difficult to suppose so lovely a country should be so malarious as it is before and after the rains, excessive heat probably diffusing widely the miasma from small stagnant surfaces. We noticed a wild hog, absolutely the first wild beast of any size I saw on the plains, except the hispid hare (*Lepus hispidus*) and the barking deer (*Stylocerus ratna*). The hare we found to be the best game of this part of India, except the teal. The pheasants of Darjeeling are poor, the deer all but uneatable, and the florican, however dressed, I considered a far from excellent bird.

A good many plants grow along the streams, the sandy beds of which are everywhere covered with the marks of tigers' feet. The only safe way of botanizing is by pushing through the jungle on elephants; an uncomfortable method, from the quantity of ants and insects which drop from the foliage above, and from the risk of disturbing pendulous bees' and ants' nests.

[1] The following is a list of the principal genera, most of which are English: *Polygonum, Quercus, Sonchus, Gnaphalium, Cratægus, Lobelia, Lactuca, Hydrocotyle, Saponaria, Campanula, Bidens, Rubus, Oxalis, Artemisia, Fragaria, Clematis. Dioscorea, Potamogeton, Chara, Veronica, Viola, Smilax.*

A peculiar species of willow (*Salix tetrasperma*) is common here; which is a singular fact, as the genus is characteristic of cold and arctic latitudes, and no species is found below 8,000 feet elevation on the Sikkim mountains, where it grows on the inner Himalaya only, some kinds ascending to 16,000 feet.

East of Siligoree the plains are unvaried by tree or shrub, and are barren wastes of short turf or sterile sand, with the dwarf-palm (*Phœnix acaulis*), a sure sign of a most hungry soil.

The latter part of the journey I performed on elephants during the heat of the day, and a more uncomfortable mode of conveyance surely never was adopted; the camel's pace is more fatiguing, but that of the elephant is extremely trying after a few miles, and is so injurious to the human frame that the Mahouts (drivers) never reach an advanced age, and often succumb young to spine-diseases, brought on by the incessant motion of the vertebral column. The broiling heat of the elephant's black back, and the odour of its oily driver, are disagreeable accompaniments, as are its habits of snorting water from its trunk over its parched skin, and the consequences of the great bulk of green food which it consumes.

From Siligoree I made a careful examination of the gravel beds that occur on the road north to the foot of the hills, and thence over the tertiary sandstone to Punkabaree. At the Rukti river, which flows south-west, the road suddenly rises, and crosses the first considerable hill, about two miles south of any rock *in situ*. This river cuts a cliff from 60 to 100 feet high, composed of stratified sand and water-worn gravel; further south, the spur declines into the plains, its course marked by the Sal that thrives on its gravelly soil. The road then runs north-west over a plain to an isolated hill about 200 feet high, also formed of sand and gravel. We ascended to the top of this, and found it covered with blocks of gneiss, and much angular detritus. Hence the road gradually ascends and becomes clayey. Argillaceous rocks, and a little ochreous sandstone appeared in highly-inclined strata, dipping north, and covered with great water-worn blocks of gneiss. Above, a flat terrace, flanked to the eastward by a low wooded hill, and another rise of sandstone, lead on to the great Baisarbatti terrace.

Bombax, *Erythrina*, and *Duabanga* (*Lagœrstrœmia grandiflora*) were in full flower, and with the profusion of *Bauhinia*, rendered the tree-jungle gay: the two former are leafless when flowering. The Duabanga is the pride of these forests. Its trunk, from eight to fifteen feet in girth, is generally forked from the base, and

the long pendulous branches which clothe the trunk for 100 feet are thickly leafy, and terminated by racemes of immense white flowers, which, especially when in bud, smell most disagreeably of assafœtida. The magnificent Apocyneous climber, *Beaumontia*, was in full bloom, ascending the loftiest trees, and clothing their trunks with its splendid foliage and festoons of enormous funnel-shaped white flowers.

The report of a bed of iron-stone eight or ten miles west of Punkabaree determined our visiting the spot; and the locality being in a dense jungle, the elephants were sent on ahead.

We descended to the terraces flanking the Balasun river, and struck west along jungle paths to a loosely-timbered flat. A sudden descent of 150 feet landed us on a second terrace. Further on, a third dip of about twenty feet (in some places obliterated) flanks the bed of the Balasun; the river itself being split into many channels at this season. The west bank, which is forty feet high, is of stratified sand and gravel, with vast slightly-worn blocks of gneiss: from the top of this we proceeded south-west for three miles to some Mechi villages, the inhabitants of which flocked to meet us, bringing milk and refreshments.

The Lohar-ghur, or "iron hill," lies in a dense dry forest. Its plain-ward flanks are very steep, and covered with scattered weather-worn masses of ochreous and black iron-stone, many of which are several yards long: it fractures with faint metallic lustre, and is very earthy in parts; it does not affect the compass. There are no pebbles of iron-stone, nor water-worn rocks of any kind found with it.

The sandstones, close by, cropped out in thick beds (dip north 70°): they are very soft, and beds of laminated clay, and of a slaty rock, are intercalated with them; also an excessively tough conglomerate, formed of an indurated blue or grey paste, with nodules of harder clay. There are no traces of metal in the rock, and the lumps of ore are wholly superficial.

Below Punkabaree the Baisarbatti stream cuts through banks of gravel overlying the sandstone (dip north 65°). The sandstone is gritty and micaceous, intercalated with beds of indurated shale and clay; in which I found the shaft (apparently) of a bone; there were also beds of the same clay conglomerate which I had seen at Lohar-ghur, and thin seams of brown lignite, with a rhomboidal cleavage. In the bed of the stream were carbonaceous shales, with obscure impressions of fern-leaves, of *Trizygia*, and *Vertebraria*: both fossils characteristic of the Burdwan coal-fields

(see p. 6), but too imperfect to justify any conclusion as to the relation between these formations.[1]

Ascending the stream, these shales are seen *in situ*, overlain by the metamorphic clay-slate of the mountains, and dipping inwards (northwards). This is at the foot of the Punkabaree spur, and close to the bungalow, where a stream and land-slip expose good sections. The carbonaceous beds dip north 60° and 70°, and run east and west; much quartz rock is intercalated with them, and soft white and pink micaceous sandstones. The coal-seams are few in number, six to twelve inches thick, very confused and distorted, and full of elliptic nodules, or spheroids of quartzy slate, covered with concentric scaly layers of coal; they overlie the sandstones mentioned above. These scanty notices of superposition being collected in a country clothed with the densest tropical forest, where a geologist pursues his fatiguing investigations under disadvantages that can hardly be realized in England, will, I fear, long remain unconfirmed. I may mention, however, that the appearance of inversion of the strata at the foot of great mountain masses has been observed in the Alleghany chain, and I believe in the Alps.[2]

A poor Mech was fishing in the stream, with a basket curiously formed of a cylinder of bamboo, cleft all round in innumerable strips, held together by the joints above and below; these strips being stretched out as a balloon in the middle, and kept apart by a hoop. A small hole is cut in the cage, and a mouse-trap entrance formed; the cage is place in the current with the open end upwards, where the fish get in, and though little bigger than minnows, cannot find their way out.

On the 20th we had a change in the weather: a violent storm

[1] These traces of fossils are not sufficient to identify the formation with that of the Sewalik hills of North-west India; but its contents, together with its strike, dip, and position relatively to the mountains, and its mineralogical character, incline me to suppose it may be similar. Its appearance in such small quantities in Sikkim (where it rises but a few hundred feet above the level of the sea, whereas in Kumaon it reaches 4,000 feet) may be attributed to the greater amount of wearing which it must have undergone; the plains from which it rises being 1,000 feet lower than those of Kumaon, and the sea having consequently retired later, exposing the Sikkim sandstone to the effects of denudation for a much longer period. Hitherto no traces of this rock, or of any belonging to a similar geological epoch, have been found in the valleys of Sikkim; but when the narrowness of these is considered, it will not appear strange that such may have been removed from their surfaces: first, by the action of a tidal ocean; and afterwards, by that of tropical rains.

[2] Dr. M'Lelland informs me that in the Curruckpore hills, south of the Ganges, the clay-slates are overlain by beds of mica-slate, gneiss, and granite, which pass into one another.

from the south-west occurred at noon, with hail of a strange form, the stones being sections of hollow spheres, half an inch across and upwards, formed of cones with truncated apices and convex bases; these cones were aggregated together with their bases outwards. The large masses were followed by a shower of the separate conical pieces, and that by heavy rain. On the moun-

A MECH, NATIVE OF THE SIKKIM TERAI.

tains this storm was most severe; the stones lay at Darjeeling for seven days, congealed into masses of ice several feet long and a foot thick in sheltered places: at Purneah, fifty miles south, stones one and two inches across fell, probably as whole spheres.

Ascending to Khersiong, I found the vegetation very backward

by the road-sides. The rain had cleared the atmosphere, and the view over the plains was brilliant. On the top of the Khersiong spur a tremendous gale set in with a cold west wind: the storm cleared off at night, which at 10 P.M. was beautiful, with forked and sheet lightning over the plains far below us. The equinoctial gales had now fairly set in, with violent south-east gales, heavy thunder, lightning, and rain.

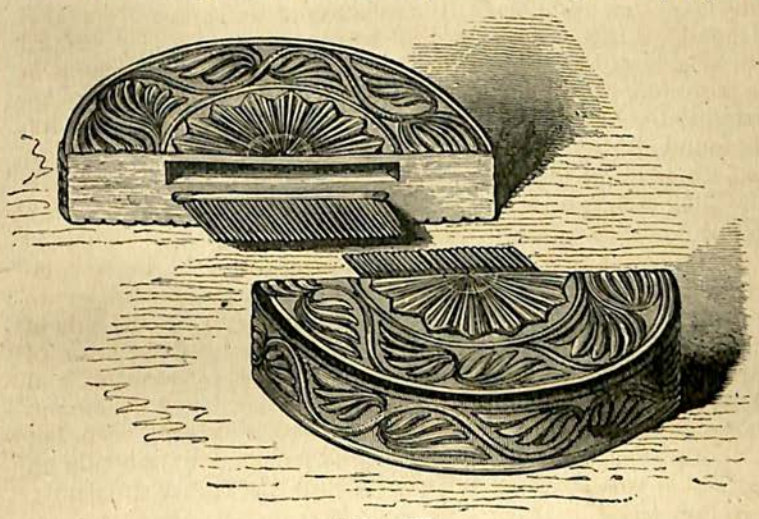
Whilst at Khersiong I took advantage of the very fair section afforded by the road from Punkabaree, to examine the structure of the spur, which seems to be composed of very highly inclined contorted beds (dip north) of metamorphic rocks, gneiss, mica-slate, clay-slate, and quartz; the foliation of which beds is parallel to the dip of the strata. Over all reposes a bed of clay, capped with a layer of vegetable mould, nowhere so thick and rich as in the more humid regions of 7,000 feet elevation. The rocks appeared in the following succession in descending: Along the top are found great blocks of very compact gneiss buried in clay. Half a mile lower the same rock appears, dipping north-north-east 50°. Below this, beds of saccharine quartz, with seams of mica, dip north-north-west 20°. Some of these quartz beds are folded on themselves, and look like flattened trunks of trees, being composed of concentric layers, each from two to four inches thick; we exposed twenty-seven feet of one fold running along the side of the road, which was cut parallel to the strike. Each layer of quartz was separted from its fellows by one of mica scales, and was broken up into cubical fragments, whose surfaces are no doubt cleavage and jointing-planes. I had previously seen, but not understood, such flexures produced by metamorphic action on masses of quartz when in a pasty state, in the Falkland Islands, where they have been perfectly well described by Mr. Darwin;[1] in whose views of the formation of these rocks I entirely concur.

The flexures of the gneiss are incomparably more irregular and confused than those of the quartz, and often contain flattened spheres of highly crystalline felspar, that cleave perpendicularly to the shorter axis. These spheres are disposed in layers parallel to the foliation of the gneiss; and are the result of a metamorphic action of great intensity, effecting a complete rearrangement and crystallization of the quartz and mica in parallel planes, whilst the felspar is aggregated in spheres; just as in the rearrangement of the mineral constituents of mica-schists the alumina is crystallized in the garnets, and in the clay-slates the iron into pyrites.

[1] "Journal of Geological Society" for 1846, p. 267, and "Voyage of the Beagle."

The quartz below this dips north-north-west 45° to 50°, and alternates with a very hard slaty schist, dipping north-west 45°, and still lower is a blue-grey clay-slate, dipping north-north-west 30°. These rest on beds of slate, folded like the quartz mentioned above, but with cleavage-planes, forming lines radiating from the axis of each flexure, and running through all the concentric folds. Below this are the plumbago and clay slates of Punkabaree, which alternate with beds of mica-schist with garnets, and appear to repose immediately upon the carboniferous strata and sandstone; but there is much disturbance at the junction.

On re-ascending from Punkabaree, the rocks gradually appear



POCKET-COMB USED BY THE MECH TRIBES.

more and more dislocated, the clay-slate less so than the quartz and mica-schist, and that again far less than the gneiss, which is so shattered and bent, that it is impossible to say what is *in situ*, and what not. Vast blocks lie superficially on the ridges; and the tops of all the outer mountains, as of Khersiong spur, of Tonglo, Sinchul, and Darjeeling, appear a pile of such masses, Injected veins of quartz are rare in the lower beds of schist and clay-slate, whilst the gneiss is often full of them; and on the inner and loftier ranges, these quartz veins are replaced by granite with tourmaline.

Lime is only known as a stalactitic deposit from various streams,

at elevations from 1,000 to 7,000 feet; one such stream occurs above Punkabaree, which I have not seen; another within the Sinchul range, on the great Rungeet river, above the exit of the Rummai; a third wholly in the great central Himalayan range, flowing into the Lachen river. The total absence of any calcareous rock in Sikkim, and the appearance of the deposit in isolated streams at such distant localities, probably indicates a very remote origin in the lime-charged waters.

From Khersiong to Darjeeling, gneiss is the only rock, and is often decomposed into clay-beds, 20 feet deep, in which the narrow, often zigzag, folia of quartz remain quite entire and undisturbed, whilst every trace of the foliation of the softer mineral is lost.

At Pacheem, Darjeeling weather, with fog and drizzle, commenced, and continued for two days; we reached Darjeeling on the 24th of March, and found that the hail which had fallen on the 20th was still lying in great masses of crumbling ice in sheltered spots. The fall had done great damage to the gardens, and Dr. Campbell's tea-plants were cut to pieces.

CHAPTER XVIII.

Arrangements for second journey into Sikkim—Opposition of Dewan—Lassoo Kajee—Tendong—Legend of flood—Lama of Sillok-foke—Namtchi—Tchebu Lama—Top of Tendong—Gigantic oak—Plants—Teesta valley—Commencement of rains—Bhomsong—Ascent to Lathiang—View—Bad road—Orchids—Gorh—Opposition of Lama—Arrival of Meepo—Cross Teesta—Difficulties of travelling—Lepchas swimming—Moxa for sprains—Singtam—Grandeur of view of Kinchinjunga—Wild men—Singtam Soubah—Landslips—Bees'-nests and honey-seekers—Leeches, &c.—Chakoong—Vegetation—Gravel terraces—Unpleasant effects of wormwood—Choongtam, scenery and vegetation of—Inhabitants—Tibetan salute—Lamas—Difficulty of procuring food—Contrast of vegetation of inner and outer Himalaya—Rhododendrons—Yew—*Abies Brunoniana*—Venomous snakes—Hornets and other insects—Choongtam temple—Pictures of Lhassa—Minerals—Scenery.

AFTER my return from the Terai, I was occupied during the month of April in preparations for an expedition to the loftier parts of Sikkim. The arrangements were the same as for my former journey, except with regard to food, which it was necessary should be sent out to me at intervals; for I had had ample proof that the resources of the country were not equal to provi-

sioning a party of from forty to fifty men, even had the Dewan been favourable to my travelling, which was clearly not the case.

Dr. Campbell communicated to the Rajah my intention of starting early in May for the upper Teesta valley, and, in the Governor-General's name, requested that he would facilitate my visiting the frontier of Sikkim, north-east of Kinchinjunga. The desired permission was, after a little delay, received; which appeared to rouse the Dewan to institute a series of obstructions to my progress, which caused so many delays that my exploration of the country was not concluded till October, and I was prevented returning to Darjeeling before the following Christmas.

Since our visit to the Rajah in December, no Vakeel (agent) had been sent by the Durbar to Darjeeling, and consequently we could only communicate indirectly with his Highness, while we found it impossible to ascertain the truth of various reports promulgated by the Dewan, and meant to deter me from entering the country. In April, the Lassoo Kajee was sent as Vakeel, but, having on a previous occasion been dismissed for insolence and incapacity, and again rejected when proposed by the Dewan at Bhomsong, he was refused an audience; and he encamped at the bottom of the Great Rungeet valley, where he lost some of his party through fever. He retired into Sikkim, exasperated, pretending that he had orders to delay my starting, in consequence of the death of the heir apparent; and that he was prepared to use strong measures should I cross the frontier.

No notice was taken of these threats; the Rajah was again informed of my intended departure, unless his own orders to the contrary were received through a proper accredited agent, and I left Darjeeling on the 3rd of May, accompanied by Dr. Campbell, who insisted on seeing me fairly over the frontier at the Great Rungeet river.

Arrangements were made for supplies of rice following me by instalments; our daily consumption being 80 lbs., a man's load. After crossing into Sikkim, I mustered my party at the Great Rungeet river. I had forty-two in all, of whom the majority were young Lepchas, or Sikkim-born people of Tibetan races: all were active and cheerful-looking fellows; only one was goitred, and he had been a salt-trader. I was accompanied by a guard of five sepoys, and had a Lepcha and Tibetan interpreter. I took but one personal servant, a Portuguese half-caste (John Hoffman by name), who cooked for me; he was a native of Calcutta, and though hardy, patient, and long-suffering, and far better-tempered, was, in other respects, very inferior to Clamanze,

who had been my servant the previous year, and who, having been bred to the sea, was as handy as he was clever; but who, like all other natives of the plains, grew intolerably weary of the hills, and left me.

The first part of my route lay over Tendong, a very fine mountain, which rises 8,613 feet, and is a conspicuous feature from Darjeeling, where it is known as Mount Ararat. The Lepchas have a curious legend of a man and woman having saved themselves on its summit during a flood that once deluged Sikkim. The coincidence of this story with the English name of Ararat suggests the probability of the legend being fabulous; but I am positively assured that it is not so, but that it was current amongst the Lepchas before its English name was heard of, and that the latter was suggested from the peculiar form of its summit resembling that given in children's books as the resting-place of the ark.

The ascent from the Great Rungeet (alt. 818 feet) is through dry woods of Sal and Pines (*P. longifolia*). I camped the first night at the village of Mikk (alt. 3,900 feet), and on the following day ascended to Namtchi (alt. 5,600 feet).

On the route I was met by the Lama of Silok-foke Goompa. Though a resident on the Lassoo Kajee's estates, he politely brought me a present, at the same time apologizing for not waiting till I had encamped, owing to his excessive fat, which prevented his climbing. I accepted his excuses, though well aware that his real reason was that he wished to pay his respects, and show his good feeling, in private. Besides his ordinary canonicals, he carried a tall crozier-headed staff, and had a curious horn slung round his neck, full of amulets; it was short, of a transparent red colour, and beautifully carved, and was that of the small cow of Lhassa, which resembles the English species, and is not a yak (it is called "Tundro").

Namtchi was once a place of considerable importance; and still possesses a mendong, with six rows of inscribed slabs; a temple, and a Lama attached thereto: the latter waited on me soon after I had encamped, but he brought no present, and I was not long kept in suspense as to his motives. These people are poor dissemblers; if they intend to obstruct, they do it clumsily and hesitatingly; in this instance the Lama first made up to my people, and, being coolly received, kept gradually edging up to my tent-door, where, after an awkward salute, he delivered himself with a very bad grace of his mission, which was from the Lassoo Kajee to stop my progress. I told him I knew nothing of the

Lassoo Kajee or his orders, and should proceed on the following morning; he then urged the bad state of the roads, and advised me to wait two days till he should receive orders from the Rajah; upon which I dismissed him.

Soon afterwards, as I sat at my tent-door, looking along the narrow bushy ridge that winds up the mountain, I saw twenty or thirty men rapidly descending the rocky path: they were Lepchas, with blue and white striped garments, bows and quivers, and with their long knives gleaming in the sun; they seemed to be following a figure in red Lama costume, with a scarlet silk handkerchief wound round his head, its ends streaming behind him. Though expecting this apparition to prove the renowned Kajee and his myrmidons, coming to put a sudden termination to my progress, I could not help admiring the exceeding picturesqueness of the scenery and party. My fears were soon dissipated by my men joyfully shouting, "The Tchebu Lama! the Tchebu Lama!" and I soon recognized the rosy face and twinkling eyes of my friend of Bhomsong (p. 208), the only man of intelligence about the Rajah's court, and the one whose services as Vakeel were particularly wanted at Darjeeling.

He told me that the Lassoo Kajee had orders (from whom he would not say) to stop my progress, but that I should proceed nevertheless, and that there was no objection to my doing so; and he despatched a messenger to the Rajah, announcing my progress, and requesting him to send me a guide, and to grant me every facility, asserting that he had all along fully intended doing so.

On the following morning the Lama proceeded to Darjeeling, and I continued the ascent of Tendong, sending my men round the shoulder to Temi in the Teesta valley, where I proposed to pass the night. The road rapidly ascends by a narrow winding path, covered with a loose forest of oaks, rhododendrons, and various shrubs, not found at equal elevations on the wetter Darjeeling ranges: amongst them the beautiful laburnum-like *Piptanthus Nepalensis*, with golden blossoms, was conspicuous. Enormous blocks of white and red stratified quartz and slate, some 20 and even 40 yards long, rest on the narrow ridge at 7,000 feet elevation. The last ascent is up a steep rounded cone with a broad flat top, covered with dwarf bamboo, a few oaks, laurels, magnolias, and white-flowered rhododendron trees (*R. argenteum*), which obstructed the view. I hung the barometers near one of the many chaits on the summit, where there is also a rude temple, in which worship is performed once a year. The

elevation is 8,671 feet by my observations.[1] The geological formation of Tendong in some measure accounts for its peculiar form. On the conical summit are hard quartzoze porphyries, which have apparently forced up the gneiss and slates, which dip in all directions from the top, and are full of injected veins of quartz. Below 7,000 feet, mica-schist prevails, always inclined at a very high angle; and I found jasper near Namtchi, with other indications of Plutonic action.

The descent on the north side was steep, through a rank vegetation, very different from that of the south face. The oaks are very grand, and I measured one (whose trunk was decayed, and split into three, however), which I found to be 49 feet in girth at 5 feet from the ground. Near Temi (alt. 4,770 feet) I gathered the fruit of *Kadsura*, a climbing plant allied to Magnolia, bearing round heads of large fleshy red drupes, which are pleasantly acid and much eaten; the seeds are very aromatic.

From Temi the road descends to the Teesta, the course of which it afterwards follows. The valley was fearfully hot, and infested with mosquitos and peepsas. Many fine plants grew in it:[2] I especially noticed *Aristolochia saccata*, which climbs the loftiest trees, bearing its curious pitcher-shaped flowers near the ground only; its leaves are said to be good food for cattle. *Houttuynia*, a curious herb allied to pepper, grew on the banks, which, from the profusion of its white flowers, resembled strawberry-beds; the leaves are eaten by the Lepchas. But the most magnificent plant of these jungles is *Hodgsonia*, (a genus I have dedicated to my friend, Mr. Hodgson), a gigantic climber allied to the gourd, bearing immense yellowish-white pendulous blossoms, whose petals have a fringe of buff-coloured curling threads, several inches long. The fruit is of a rich brown, like a small melon in form, and contains six large nuts, whose kernels (called "Katiorpot" by the Lepchas) are eaten. The stem, when cut, discharges water profusely from whichever end is held downwards. The "Took" (*Hydnocarpus*) is a beautiful evergreen tree, with tufts of yellow blossoms on the trunk; its fruit is as large as an orange, and is used to poison fish, while from the seeds an oil is expressed. Tropical oaks and Terminalias are the giants of these low forests, the latter especially, having buttressed trunks, appear truly gigantic; one, of a kind called "Sung-lok" measured 47 feet

[1] 8,663 by Col. Waugh's trigonometrical observations.

[2] Especially upon the broad terraces of gravel, some of which are upwards of a mile long, and 200 feet above the stream; they are covered with boulders of rock, and are generally opposite feeders of the river.

in girth, at 5 feet, and 21 and 15 feet from the ground, and was fully 200 feet high. I could only procure the leaves by firing a ball into the crown. Some of their trunks lay smouldering on the ground, emitting a curious smell from the mineral matter in their ashes.

Birds are very rare, as is all animal life but insects, and a small fresh-water crab, *Thelphusa*, ("Ti-hi" of the Lepchas.) Shells, from the absence of lime, are extremely scarce, and I scarcely picked up a single specimen; the most common are species of *Cyclostoma*.

The rains commenced on the 10th of May, greatly increasing the discomforts of travelling, but moderating the heat by drenching thunder-storms, which so soaked the men's loads, that I was obliged to halt a day in the Teesta valley to have waterproof covers made of platted bamboo work, enclosing Phrynium leaves. I was delighted to find that my little tent was impervious to water, though its thickness was of but one layer of blanket; it was a single ridge with two poles, 7 feet high, 8 feet long, and 8 feet broad at the base, forming nearly an equilateral triangle in front.

Bhomsong was looking more beautiful than ever in its rich summer clothing of tropical foliage. I halted during an hour of heavy rain on the spot where I had spent the previous Christmas, and could not help feeling doubly lonely in a place where every rock and tree reminded me of that pleasant time. The isolation of my position, the hostility of the Dewan, and consequent uncertainty of the success of a journey that absorbed all my thoughts, the prevalence of fevers in the valleys I was traversing, and the many difficulties that beset my path, all crowded on the imagination when fevered by exertion and depressed by gloomy weather, and my spirits involuntarily sank as I counted the many miles and months intervening between me and my home.

The little flat on which I had formerly encamped was now covered with a bright green crop of young rice. The house then occupied by the Dewan was now empty and unroofed; but the suspension bridge had been repaired, and its light framework of canes, spanning the boiling flood of the Teesta, formed a graceful object in this most beautiful landscape. The temperature of the river was 58°, only 7° above that of mid-winter, owing to the now melting snows. I had rather expected to meet either with a guide, or with some further obstruction here, but as none appeared, I proceeded onwards as soon as the weather moderated.

Higher up, the scenery resembles that of Chingtam on the

Tambur (p. 137): the banks are so steep as to allow of no road, and the path ascends from the river, at 1,000 feet, to Lathiang village, at 4,800 feet, up a wild, rocky torrent that descends from Mainom to the Teesta. The cliffs here are covered with wild plantains and screw-pines (*Pandanus*), 50 feet high, that clasp

PANDANUS. SIKKIM SCREW-PINE.

the rocks with cable-like roots, and bear one or two crowns of drooping leaves, 5 feet long: two palms, Rattan (*Calamus*) and *Areca gracilis*, penetrate thus far up the Teesta valley, but are scarcely found further.

From the village the view was superb, embracing the tropical

gulley below, with the flat of Bhomsong deep down in the gorge, its bright rice-fields gleaming like emeralds amid the dark vegetation that surrounded it; the Teesta winding to the southward, the pine-clad rocky top of Mainom, 10,613 feet high, to the south-west, the cone of Mount Ararat far to the south, to the north black mountains tipped with snow, and to the east the magnificent snowy range of Chola, girdling the valley of the Ryott with a diadem of frosted silver. The coolies, each carrying upwards of 80 lb. load, had walked twelve hours that day, and besides descending 2,000 feet, they had ascended nearly 4,000 feet, and gone over innumerable ups and downs besides.

Beyond Lathiang, a steep and dangerous path runs along the east flank of Mainom, sometimes on narrow ledges of dry rock, covered with long grass, sometimes dipping into wooded gullies, full of *Edgeworthia Gardneri* and small trees of Andromeda and rhododendron, covered with orchids[1] of great beauty.

Descending to Gorh (4,100 feet), I was met by the Lama of that district, a tall, disagreeable-looking fellow, who informed me that the road ahead was impassable. The day being spent, I was obliged to camp at any rate; after which he visited me in full canonicals, bringing me a handsome present, but assuring me that he had no authority to let me advance. I treated him with civility, and regretted my objects being so imperative, and my orders so clear, that I was obliged to proceed on the following morning: on which he abruptly decamped, as I suspected, in order to damage the paths and bridges. He came again at daylight, and expostulated further; but finding it of no use, he volunteered to accompany me, officiously offering me the choice of two roads. I asked for the coolest, knowing full well that it was useless to try and outwit him in such matters. At the first stream the bridge was destroyed, but seeing the planks peeping through the bushes in which they had been concealed, I desired the Lama to repair it, which he did without hesitation. So it was at every point: the path was cumbered with limbs of trees, crossing-stones were removed from the streams, and all natural difficulties were increased. I kept constantly telling the Lama that as he had volunteered to show me the road, I felt sure he intended to remove all obstacles, and accordingly I put him to all the trouble I possibly could, which he took with a very indifferent grace. When I arrived at the swinging bridge across the Teesta, I found that the canes were loosened, and that slips

[1] Especially some species of *Sunipia* and *Cirrhopetalum*, which have not yet been introduced into England.

of bamboo, so small as nearly to escape observation, were ingeniously placed low down over the single bamboo that formed the footing, intended to trip up the unwary passenger, and overturn him into the river, which was deep, and with a violent current. Whilst the Lama was cutting these, one of my party found a charcoal writing on a tree, announcing the speedy arrival from the Rajah of my old guide, Meepo; and he shortly afterwards appeared, with instructions to proceed with me, though not to the Tibetan frontier. The lateness of the season, the violence of the rains, and the fears, on the Rajah's part, that I might suffer from fever or accident, were all urged to induce me to return, or at least only to follow the west branch of the Teesta to Kinchinjunga. These reasons failing, I was threatened with Chinese interference on the frontier. All these objections I overruled, by refusing to recognize any instructions that were not officially communicated to the Superintendent of Darjeeling.

The Gorh Lama here took leave of me: he was a friend of the Dewan, and was rather surprised to find that the Rajah had sent me a guide, and now attempted to pass himself off as my friend, pompously charging Meepo with the care of me, and bidding me a very polite farewell. I could not help telling him civilly, but plainly, what I thought of him; and so we parted.

Meepo was very glad to join my party again: he is a thorough Lepcha in heart, a great friend of his Rajah and of Tchebu Lama, and one who both fears and hates the Dewan. He assured me of the Rajah's good wishes and intentions, but spoke with great doubt as to the probability of a successful issue to my journey: he was himself ignorant of the road, but had brought a guide, whose appearance, however, was against him, and who turned out to be sent as a spy on us both.

Instead of crossing the Teesta here, we kept on for two days up its west bank, to a cane bridge at Lingo, where the bed of the river is still only 2,000 feet above the sea, though 45 miles distant from the plains, and flowing in a valley bounded by mountains 12,000 to 16,000 feet high. The heat was oppressive, from the closeness of the atmosphere, the great power of the sun, now high at noon-day, and the reflection from the rocks. Leeches began to swarm as the damp increased, and stinging flies of various kinds. My clothes were drenched with perspiration during five hours of every day; and the crystallising salt irritated the skin, On sitting down to rest, I was overcome with languor and sleep. and, but for the copious supply of fresh water everywhere, travelling would have been intolerable. The coolies were all but

naked, and were constantly plunging into the pools of the rivers; for, though filthy in their persons, they revel in cold water in summer. They are powerful swimmers, and will stem a very strong current, striking out with each arm alternately. It is an animated sight when twenty or thirty of these swarthy children of nature are disporting their muscular figures in the water, diving after large fish, and sometimes catching them by tickling them under the stones.

Of plants I found few not common at similar elevations below Darjeeling, except another kind of Tree-fern,[1] whose pith is eaten in times of scarcity. The India-rubber fig penetrates thus far amongst the mountains, but is of small size. A Gentian, *Arenaria*, and some sub-alpine plants are met with, though the elevation is only 2,000 feet, and the whole climate thoroughly tropical: they were annuals usually found at 7,000 to 10,000 feet elevation, and were growing here on mossy rocks, cooled by the spray of the river, whose temperature was only 56° 3. My servant having severely sprained his wrist by a fall, the Lepchas wanted to apply a moxa, which they do by lighting a piece of puff ball, or Nepal paper that burns like tinder, laying it on the skin, and blowing it till a large open sore is produced; they shook their heads at my treatment, which consisted in transferring some of the leeches from our persons to the inflamed part.

After crossing the Teesta by the cane bridge of Lingo, our route lay over a steep and lofty spur, round which the river makes a great sweep. On the ascent of this ridge we passed large villages on flats cultivated with buckwheat. The saddle is 5,500 feet high, and thence a rapid descent leads to the village of Singtam, which faces the north, and is 300 feet lower, and 3,000 feet above the river, which is here no longer called the Teesta, but is known as the Lachen-Lachoong, from its double origin in the rivers of these names, which unite at Choongtam, twenty miles higher up. Of these, the source of the Lachen is in the Cholamoo lakes in Tibet; while the Lachoong rises on the south flank of Donkia mountain, both many marches north of my present position. At Singtam the Lachen-Lachoong runs westward, till joined by the Rihi from the north, and the Rinoong from the west, after receiving which it assumes the name of Teesta. Of these affluents, the Rinoong is the largest, and drains the south-east face of Kinchin-

[1] *Alsophila spinulosa*, the "Pugjik" of the Lepchas, who eat the soft watery pith: it is abundant in East Bengal and the Peninsula of India. The other Sikkim Tree-fern, *A. gigantea*, is far more common from the level of the plains to 6,500 elevation, and is found as far south as Java.

junga and Pundim, and the north of Nursing; all which mountains are seen to the north-north-west of Singtam. The Rinoong valley is cultivated for several miles up, and has amongst others the village and Lamasery of Bah. Beyond this the view of black, rugged precipices with snowy mountains towering above them, is one of the finest in Sikkim. There is a pass in that direction, from Bah over the Tekonglah to the Thlonok valley, and thence to the province of Jigatzi in Tibet, but it is almost impracticable.

A race of wild men, called "Harrum-mo," are said to inhabit the head of the valley, living in the woods of a district called Mund-po, beyond Bah; they shun habitations, speak an unintelligible tongue, have more hair on the face than Lepchas, and do not plait that of their heads, but wear it in a knot; they use the bow and arrow, and eat snakes and vermin, which the Lepchas will not touch. Such is the account I have heard, and which is certainly believed in Sikkim; similar stories are very current in half civilized countries; and if this has any truth, it possibly refers to the Chepangs,[1] a very remarkable race, of doubtful affinity and origin, inhabiting the Nepal forests.

At Singtam I was waited on by the Soubah of the district, a tall portly Bhoteea, who was destined to prove a most active enemy to my pursuits. He governs the country between Gorh and the Tibet frontier, for the Maha-Ranee (wife of the Rájah), whose dowry it *is*; and she being the Dewan's relative, I had little assistance to expect from her agent. His conduct was very polite, and he brought me a handsome offering for myself; but after delaying me a day on the pretext of collecting food for my people, of which I was in want, I was obliged to move on with no addition to my store, and trust to obtaining some at the next village, or from Darjeeling. Owing, however, to the increasing distance, and the destruction of the roads by the rains, my supplies from that place were becoming irregular: I therefore thought it prudent to reduce my party, by sending back my guard of sepoys, who could be of no further use.

From this point the upper portion of the course of the Teesta (Lachen-Lachoong) is materially different from what it is lower down; becoming a boisterous torrent, as suddenly as the Tambur does above Mywa Guola. Its bed is narrower, large masses of rock impede its course, nor is there any place where it is practicable for rafts at any season; the only means of passing it being by cane bridges that are thrown across, high above the stream.

[1] Hodgson, in "Bengal Asiatic Society's Journal" for 1848.

The slope on either side of the valley is very steep; that on the north, in particular, appearing too precipitous for any road, and being only frequented by honey seekers, who scale the rocks by cane ladders, and thus reach the pendulous bees'-nests, which are so large as in some instances to be conspicuous features at the distance of a mile. This pursuit appeared extremely perilous, the long thread-like canes in many places affording the only footing, over many yards of cliff; the procuring of this honey, however, is the only means by which many of the idle poor raise the rent which they must pay to the Rajah.

The most prominent effect of the steepness of the valleys is the prevalence of land-slips, which sometimes descend for 3,000 feet, carrying devastation along their course: they are caused either by the melting of the snow-beds on the mountains, or by the action of the rains on the stratified rocks, and are much increased in effect and violence by the heavy timber-trees which, swaying forwards, loosen the earth at their roots, and give impetus to the mass. This phenomenon is as frequent and destructive as in Switzerland, where, however, more lives are lost, from the country being more populous, and from the people recklessly building in places particularly exposed to such accidents. A most destructive one had, however, occurred here the previous year, by which a village was destroyed, together with twelve of its inhabitants, and all the cattle. The fragments of rock precipitated are sometimes of enormous size, but, being a soft mica-schist, are soon removed by weathering. It is in the rainy season that landslips are most frequent, and shortly after rain they are pretty sure to be heard far or near. I crossed the débris of the great one alluded to on the first march beyond Singtam: the whole face of the mountain appeared more or less torn up for fully a mile, presenting a confused mass of white micaceous clay, full of angular masses of rock. The path was very difficult and dangerous, being carried along the steep slope, at an angle, in some places, of 35°; and it was constantly shifting, from the continued downward sliding, and from the action of streams, some of which are large, and cut deep channels. In one I had the misfortune to lose my only sheep, which was carried away by the torrent. These streams were crossed by means of sticks and ricketty bamboos, and the steep sides (sometimes twenty or thirty feet high), were ascended by notched poles.

The weather continued very hot for the elevation (4,000 to 5,000 feet), the rain brought no coolness, and for the greater part of the three marches between Singtam and Chakoong, we were

either wading through deep mud, or climbing over rocks. Leeches swarmed in incredible profusion in the streams and damp grass, and among the bushes: they got into my hair, hung on my eyelids, and crawled up my legs and down my back. I repeatedly took upwards of a hundred from my legs, where the small ones used to collect in clusters on the instep: the sores which they produced were not healed for five months afterwards, and I retain the scars to the present day. Snuff and tobacco leaves are the best antidote, but when marching in the rain, it is impossible to apply this simple remedy to any advantage. The best plan I found to be rolling the leaves over the feet, inside the stockings, and powdering the legs with snuff.

Another pest is a small midge, or sand-fly, which causes intolerable itching, and subsequent irritation, and is in this respect the most insufferable torment in Sikkim; the minutest rent in one's clothes is detected by the acute senses of this insatiable bloodsucker, which is itself so small as to be barely visible without a microscope. We daily arrived at our camping-ground, streaming with blood, and mottled with the bites of peepsas, gnats, midges, and mosquitos, besides being infested with ticks.

As the rains advanced, insects seemed to be called into existence in countless swarms; large and small moths, cockchafers, glow-worms, and cockroaches made my tent a Noah's ark by night, when the candle was burning; together with winged ants, May-flies, flying earwigs, and many beetles, while a very large species of *Tipula* (daddy-long-legs,) swept its long legs across my face as I wrote my journal, or plotted off my map. After retiring to rest and putting out the light, they gradually departed, except a few which could not find the way out, and remained to disturb my slumbers.

Chakoong is a remarkable spot in the bottom of the valley, at an angle of the Lachen-Lachoong, which here receives an affluent from Gnarem, a mountain 17,577 feet high, on the Chola range to the east.[1] There is no village, but some grass huts used by travellers, which are built close to the river on a very broad flat, fringed with alder, hornbeam, and birch; the elevation is 4,400 feet, and many European genera not found about Darjeeling, and belonging to the temperate Himalaya, grow intermixed with tropical plants that are found no further north. The birch, willow, alder, and walnut grow side by side with wild plantain, *Erythrina*,

[1] This is called Black Rock in Col. Waugh's map. I doubt Gnarem being a generally known name: the people hardly recognize the mountain as sufficiently conspicuous to bear a name.

Wallichia palm, and gigantic bamboos: the *Cedrela Toona*, figs, *Melastoma*, *Scitamineæ*, balsams, *Pothos*, peppers, and gigantic climbing vines, grow mixed with brambles, speedwell, *Paris*, forget-me-not, and nettles that sting like poisoned arrows. The wild English strawberry is common, but bears a tasteless fruit: its inferiority is, however, counterbalanced by the abundance of a grateful yellow raspberry. Parasitical orchids (*Dendrobium nobile*, and *densiflorum*, &c.), cover the trunks of oaks, while *Thalictrum* and *Geranium* grow under their shade. *Monotropa* and *Balanophora*, both parasites on the roots of trees (the one a native of north Europe and the other of a tropical climate), push their leafless stems and heads of flowers through the soil together; and lastly, tree-ferns grow associated with the *Pteris aquilina* (brake) and *Lycopodium clavatum* of our British moors; and amongst mosses, the superb Himalayan *Lyellia crispa*,[1] with the English *Funaria hygrometrica*.

The dense jungles of Chakoong completely cover the beautiful flat terraces of stratified sand and gravel, which rise in three shelves to 150 feet above the river, and whose edges appear as sharply cut as if the latter had but lately retired from them. They are continuous with a line of quartzy cliffs, covered with scarlet rhododendrons, and in the holes of which a conglomerate of pebbles is found, 150 feet above the river. Everywhere immense boulders are scattered about, some of which are sixty yards long: their surfaces are water-worn into hollows, proving the river to have cut through nearly 300 feet of deposit, which once floored its valley. Lower down the valley, and fully 2,000 feet above the river, I had passed numerous angular blocks resting on gentle slopes where no landslips could possibly have deposited them; and which I therefore refer to ancient glacial action: one of these, near the village of Niong, was nearly square, eighty feet long, and ten high.

It is a remarkable fact, that this hot, damp gorge is never malarious; this is attributable to the coolness of the river, and to the water on the flats not stagnating; for at Choongtam, a march further north, and 1,500 feet higher, fevers and ague prevail in summer on similar flats, but which have been cleared of jungle, and are therefore exposed to the sun.

I had had constant headache for several mornings on waking,

[1] This is one of the most remarkable mosses in the Himalaya mountains, and derives additional interest from having been named after the late Charles Lyell, Esq., of Kinnordy, the father of the most eminent geologist of the present day.

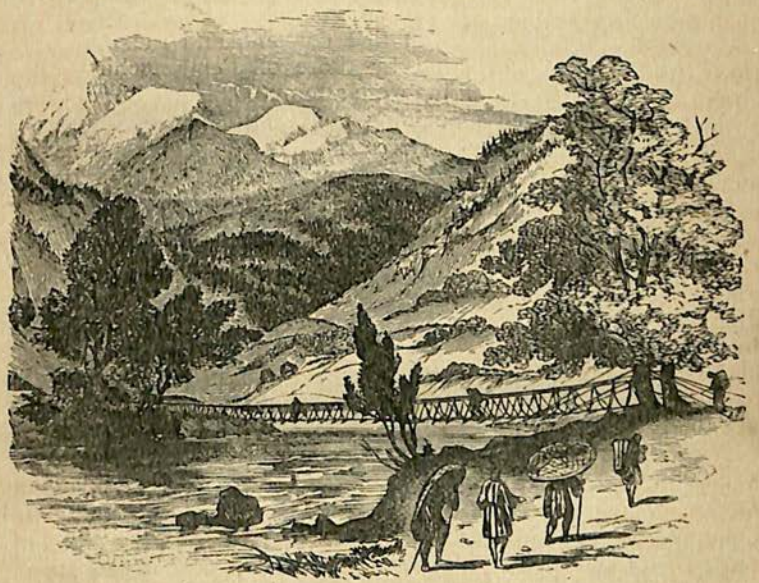
which I did not fail to attribute to coming fever, or to the unhealthiness of the climate; till I accidentally found it to arise from the wormwood, upon a thick couch of the cut branches of which I was accustomed to sleep, and which in dry weather produced no such effects.[1]

From Chakoong to Choongtam the route lay northwards, following the course of the river, or crossing steep spurs of vertical strata, of mica-schist, that dip into the valley, and leave no space between their perpendicular sides and the furious torrent. Immense landslips seamed the steep mountain flanks; and we crossed with precipitation one that extended fully 4,000 feet (and perhaps much more) up a mountain 12,000 feet high, on the east bank: it moves every year, and the mud and rocks shot down by it were strewn with the green leaves and twigs of shrubs, some of the flowers on which were yet fresh and bright, while others were crushed: these were mixed with gigantic trunks of pines, with ragged bark and scored timbers. The talus which had lately been poured into the valley formed a gently sloping bank, twenty feet high, over which the Lachen-Lachoong rolled, from a pool above, caused by the damming up of its waters. On either side of the pool were cultivated terraces of stratified sand and pebbles, fifty feet high, whose alder-fringed banks, joined by an elegant cane bridge, were reflected in the placid water; forming a little spot of singular quiet and beauty, that contrasted with the savage grandeur of the surrounding mountains, and the headstrong course of the foaming torrent below, amid whose deafening roar it was impossible to speak and be heard.

The mountain of Choongtam is about 10,000 feet high; it divides the Lachen from the Lachoong river, and terminates a lofty range that runs for twenty-two miles south from the lofty mountain of Kinchinjhow. Its south exposed face is bare of trees, except clumps of pines towards the top, and is very steep, grassy, and rocky, without water. It is hence quite unlike the forest-clad mountains further south, and indicates a drier and more sunny climate. The scenery much resembles that of Switzerland, and of the north-west Himalaya, especially in the great contrast between the southern and northern exposures, the latter being always clothed with a dense vegetation. At the foot of this very steep mountain is a broad triangular flat, 5,270 feet above the sea, and 300 feet above the river, to which it descends by

[1] This wormwood (*Artemisia Indica*) is one of the most common Sikkim plants at 2,000 to 6,000 feet elevation, and grows twelve feet high: it is a favourite food of goats.

three level cultivated shelves. The village, consisting of a temple and twenty houses, is placed on the slope of the hill. I camped on the flat in May, before it became very swampy, close to some great blocks of gneiss, of which many lie on its surface: it was covered with tufts of sedge (like *Carex stellulata*), and fringed with scarlet rhododendron, walnut, *Andromeda*, *Elæagnus* (now bearing pleasant acid fruit), and small trees of a *Photinia*, a plant allied to hawthorn, of the leaves of which the natives make tea (as they do of *Gualtheria*, *Andromeda*, *Vaccinium*, and other allied plants). Rice, cultivated[1] in pools surrounded by low



CANE-BRIDGE ANU TUKCHAM MOUNTAIN.

banks, was just peeping above ground; and scanty crops of millet, maize, and buckwheat flourished on the slopes around.

The inhabitants of Choongtam are of Tibetan origin; few of them had seen an Englishman before, and they flocked out, displaying the most eager curiosity: the Lama and Phipun (or superior officer) of the Lachoong valley came to pay their respects

[1] Choongtam is in position and products analogous to Lelyp, on the Tambur. Rice cultivation advances thus high up each valley, and at either place Bhoteeas replace the natives of the lower valleys.

with a troop of followers, and there was lolling out of tongues, and scratching of ears, at every sentence spoken, and every object of admiration. This extraordinary Tibetan salute at first puzzled me excessively, nor was it until reading MM. Huc and Gabet's travels on my return to England, that I knew of its being the *ton* at Lhassa, and in all civilised parts of Tibet.

As the valley was under the Singtam Soubah's authority, I experienced a good deal of opposition; and the Lama urged the wrath of the gods against my proceeding. This argument, I said, had been disposed of the previous year, and I was fortunate in recognising one of my Changachelling friends, who set forth my kindly offices to the Lamas of that convent, and the friendship borne me by its monks, and by those of Pemiongchi. Many other modes of dissuading me were attempted, but with Meepo's assistance I succeeded in gaining my point. The difficulty and delays in remittance of food, caused by the landslips having destroyed the road, had reduced our provisions to a very low ebb; and it became not only impossible to proceed, but necessary to replenish my stores on the spot. At first provisions enough were brought to myself, for the Rajah had issued orders for my being cared for, and having some practice among the villagers in treating rhematism and goîtres, I had the power of supplying my own larder; but I found it impossible to buy food for my people. At last, the real state of the case came out; that the Rajah having gone to Choombi, his usual summer-quarters in Tibet, the Dewan had issued orders that no food should be sold or given to my people, and that no roads were to be repaired during my stay in the country; thus cutting off my supplies from Darjeeling, and, in short, attempting to starve me out. At this juncture, Meepo received a letter from the Durbar, purporting to be from the Rajah, commanding my immediate return, on the grounds that I had been long enough in the country for my objects: it was not addressed to me, and I refused to receive it as an official communication; following up my refusal by telling Meepo that if he thought his orders required it, he had better leave me and return to the Rajah, as I should not stir without directions from Dr. Campbell, except forwards. He remained, however, and said he had written to the Rajah, urging him to issue stringent orders for my party being provisioned.

We were reduced to a very short allowance before the long-expected supplies came, by which time our necessities had almost conquered my resolution not to take by force of the abundance I might see around, however well I might afterwards pay. It is

but fair to state that the improvident villagers throughout Sikkim are extremely poor in vegetable food at this season, when the winter store is consumed, and the crops are still green. They are consequently obliged to purchase rice from the lower valleys, which, owing to the difficulties of transport, is very dear; and to obtain it they barter wool, blankets, musk, and Tibetan produce of all kinds. Still, they had cattle, which they would willingly have sold to me, but for the Dewan's orders.

There is a great difference between the vegetation of Darjeeling and that of similar elevations near Choongtam situated far within the Himalaya: this is owing to the steepness and dryness of the latter locality, where there is an absence of dense forest, which is replaced by a number of social grasses clothing the mountain sides, many new and beautiful kinds of rhododendrons, and a variety of European genera,[1] which, (as I have elsewhere noticed) are either wholly absent from the damper ranges of Darjeeling, or found there several thousand feet higher up. On the hill above Choongtam village, I gathered, at 5,000 to 6,000 feet, *Rhododendron arboreum* and *Dalhousiæ*, which do not generally grow at Darjeeling below 7,500 feet.[2] The yew appears at 7,000 feet, whilst, on the outer ranges (as on Tonglo), it is only found at 9,500 to 10,000 feet; and whereas on Tonglo it forms an immense tall tree, with long sparse branches and slender drooping twigs, growing amongst gigantic magnolias and oaks, at Choongtam it is small and rigid, and much resembling in appearance our churchyard yew.[3] At 8,000 feet the *Abies Brunoniana* is found; a tree quite unknown further south; but neither the larch nor the *Abies Smithiana* (Khutrow) accompanied it, they being confined to still more northern regions.

I have seldom had occasion to allude to snakes, which are rare and shy in most parts of the Himalaya; I, however, found an

[1] *Deutzia*, *Saxifraga ciliata*, *Thalictrum*, *Euphorbia*, yellow violet, *Labiatæ*, *Androsace*, *Leguminosæ*, *Coriaria*, *Delphinium*, currant, *Umbelliferæ*, primrose, *Anemone*, *Convallaria*, *Roscoea*, *Mitella*, *Herminium*, *Drosera*.

[2] I collected here ten kinds of rhododendron, which, however, are not the social plants that they become at greater elevations. Still, in the delicacy and beauty of their flowers, four of them, perhaps, excel any others; they are *R. Aucklandii*, whose flowers are five inches and a half in diameter; *R. Maddeni*, *R. Dalhousiæ*, and *R. Edgeworthii*, all white-flowered bushes, of which the two first rise to the height of small trees.

[3] The yew spreads east from Kashmir to the Assam Himalaya and the Khasia mountains; and the Japan, Philippine Island, Mexican, and other North American yews, belong to the same widely-diffused species. In the Khasia (its most southern limit) it is found as low as 5,000 feet above the sea-level.

extremely venomous one at Choongtam; a small black viper, a variety of the cobra di capello,[1] which it replaces in the drier grassy parts of the interior of Sikkim, the large cobra not inhabiting the mountain regions. Altogether I only collected about twelve species in Sikkim, seven of which are venomous, and all are dreaded by the Lepchas. An enormous hornet (*Vespa magnifica*, Sm.), nearly two inches long, was here brought to me alive in a cleft-stick, lolling out its great thorn-like sting, from which drops of a milky poison distilled: its sting is said to produce fatal fevers in men and cattle, which may very well be the case, judging from that of a smaller kind, which left great pain in my hand for two days, while a feeling of numbness remained in the arm for several weeks. It is called Vok by the Lepchas, a common name for any bee: its larvæ are said to be greedily eaten, as are those of various allied insects.

Choongtam boasts a profusion of beautiful insects, amongst which the British swallow-tail butterfly (*Papilio Machaon*) disports itself in company with magnificent black, gold, and scarlet-winged butterflies, of the Trojan group, so typical of the Indian tropics. At night my tent was filled with small water-beetles (*Berosi*) that quickly put out the candle; and with lovely moths came huge cockchafers (*Encerris Griffithii*), and enormous and fœtid flying-bugs (of the genus *Derecterix*), which bear great horns on the thorax. The irritation of mosquito and midge bites, and the disgusting insects that clung with spiny legs to the blankets of my tent and bed, were often as effectual in banishing sleep, as were my anxious thoughts regarding the future.

The temple at Choongtam is a poor wooden building, but contains some interesting drawings of Lhassa, with its extensive Lamaseries and temples; they convey the idea of a town, gleam-

[1] Dr. Gray, to whom I am indebted for the following information, assures me that this reptile is not specifically distinct from the common Cobra of India; though all the mountain specimens of it which he has examined retain the same size and dark colour. Of the other Sikkim reptiles which I procured, seven are *Colubridæ* and innocuous; five *Crotalidæ* are venomous, three of which are new species belonging to the genera *Parias* and *Trimesurus*. Lizards are not abundant, but I found at Choongtam a highly curious one, *Plestiodon Sikkimensis*, Gray; a kind of Skink, whose only allies are two North American congeners; and a species of *Agama* (a chameleon-like lizard) which in many important points more resembled an allied American genus than an Asiatic one. The common immense earth-worth of Sikkim, *Ichthyophis glutinosus*, is a native of the Khasia mountains, Singapore, Ceylon and Java. It is a most remarkable fact, that whereas seven out of the twelve Sikkim snakes are poisonous, the sixteen species I procured in the Khasia mountains are innocuous.

ing, like Moscow, with gilded and copper roofs; but on a nearer aspect it is found to consist of a mass of stone houses, and large religious edifices many stories high, the walls of which are regularly pierced with small square ornamented windows.[1]

JUNIPERUS RECURVA.
Height 30 feet. (See p. 318.)

[1] MM. Huc and Gabet's account of Lhassa is, I do not doubt, excellent as to particulars; but the trees which they describe as magnificent, and girdling the city, have uniformly been represented to me as poor stunted willows, apricots, poplars, and walnuts, confined to the gardens of the rich. No doubt, the impression left by these objects on the minds of travellers from tree-less Tartary, and of Sikkimites reared amidst stupendous forests, must be widely different. The information concerning Lhassa collected by Timkowski, "Travels of the Russian Mission to China" (in 1821), is greatly exaggerated,

There is nothing remarkable in the geology of Choongtam: the base of the hill consists of the clay and mica slates overlain by gneiss, generally dipping to the eastward; in the latter are granite veins, containing fine tourmalines. Actinolites are found in some highly metamorphic gneisses, brought by landslips from the neighbouring heights. The weather in May was cloudy and showery, but the rain which fell was far less in amount than that at Darjeeling: during the day the sun's power was great; but though it rose between five and six A.M., it never appeared above the lofty peaked mountains that girdle the valley till eight A.M. Dark pines crest the heights around, and landslips score their flanks with white seams below; while streaks of snow remain throughout the month at 9,000 feet above; and everywhere silvery torrents leap down to the Lachen and Lachoong.

CHAPTER XIX.

Routes from Choongtam to Tibet frontier—Choice of that by the Lachen river—Arrival of Supplies—Departure—Features of the valley—Eatable *Polygonum*—Tumlong—Cross Taktoong river—Pines, larches, and other trees—Chateng pool—Water-plants and insects—Tukcham mountain—Lamteng village—Inhabitants—Alpine monkey—Botany of temperate Himalaya—European and American fauna—Japanese and Malayan genera—Superstitious objections to shooting—Customs of people—Rain—Run short of provisions—Altered position of Tibet frontier—Zemu Samdong—Imposition—Vegetation—Uses of pines—Ascent to Thlonok river—Balanophora wood for making cups—Snow-beds—Eatable mushrooms and *Smilacina*—Asarabacca—View of Kinchinjunga—Arum-roots, preparation of for food—Liklo mountain—Behaviour of my party—Bridge constructed over Zemu—Cross river—Alarm of my party—Camp on Zemu river.

FROM this place there were two routes to Tibet, each of about six days' journey. One lay to the north-west up the Lachen valley to the Kongra Lama pass, the other to the east up the

though containing much that is true and curious. The dyke to protect the city from inundations I never heard of; but there is a current story in Sikkim that Lhassa is built in a lake-bed, which was dried up by a miracle of the Lamas, and that in heavy rain the earth trembles, and the waters bubble through the soil: a Darjeeling rain-fall, I have been assured, would wash away the whole city. Ermann ("Travels in Siberia," i., p. 186), mentions a town (Klinchi, near Perm) thus built over subterraneous springs, and in constant danger of being washed away. MM. Huc and Gabet allude to the same tradition under another form. They say that the natives of the banks of the Koko-nor affirm that the waters of that lake once occupied a subterranean position beneath Lhassa, and that the waters sapped the foundations of the temples as soon as they were built, till withdrawn by supernatural agency.

Lachoong to the Donkia pass. The latter river has its source in small lakes in Sikkim, south of the Donkia mountain, a shoulder of which the pass crosses, commanding a magnificent view into Tibet. The Lachen, on the other hand (the principal source of the Teesta), rises beyond Sikkim in the Cholamoo lakes. The frontier at Kongra Lama was described to me as being a political, and not a natural boundary, marked out by cairns, standing on a plain, and crossing the Lachen river. To both Donkia and Kongra Lama I had every right to go, and was determined, if possible, to reach them, in spite of Meepo's ignorance, our guide's endeavours to frighten my party and mislead myself, and the country people's dread of incurring the Dewan's displeasure.

The Lachen valley being pronounced impracticable in the height of the rains, a month later, it behoved me to attempt it first, and it possessed the attraction of leading to a frontier described as far to the northward of the snowy Himalaya, on a lofty plateau, whose plants and animals were different from anything I had previously seen.

After a week the coolies arrived with supplies: they had been delayed by the state of the paths, and had consequently consumed a great part of my stock, reducing it to eight days' allowance. I therefore divided my party, leaving the greater number at Choongtam, with a small tent, and instructions to forward all food to me as it arrived. I started with about fifteen attendants, on the 25th of May, for Lamteng, three marches up the Lachen.

Descending the step-formed terraces, I crossed the Lachen by a good cane bridge. The river is a headstrong torrent, and turbid from the vast amount of earthy matter which it bears along; and this character of extreme impetuosity, unbroken by any still bend, or even swirling pool, it maintains uninterruptedly at this season from 4,000 to 10,000 feet. It is crossed three times, always by cane bridges, and I cannot conceive any valley of its nature to be more impracticable at such a season. On both sides the mountains rose, densely forest-clad, at an average angle of 35° to 40°, to 10,000 and 15,000 feet. Its extreme narrowness, and the grandeur of its scenery, were alike recalled to my mind, on visiting the Sachs valley in the Valais of Switzerland; from which, however, it differs in its luxuriant forest, and in the slopes being more uniform and less broken up into those imposing precipices so frequent in Switzerland, but which are wanting in the temperate regions of the Sikkim Himalaya.

At times we scrambled over rocks 1,000 feet above the river, or descended into gorges, through whose tributary torrents we

waded, or crossed swampy terraced flats of unstratified shingle above the stream; whilst it was sometimes necessary to round rocky promontories in the river, stemming the foaming torrent that pressed heavily against the chest as, one by one, we were dragged along by powerful Lepchas. Our halting-places were on flats close to the river, covered with large trees, and carpeted with a most luxuriant herbage, amongst which a wild buckwheat (*Polygonum*)[1] was abundant, which formed an excellent spinach: it is called "Pullop-bi"; a name I shall hereafter have occasion to mention with gratitude.

A few miles above Choongtam, we passed a few cottages on a very extensive terrace at Tumlong, but between this and Lamteng the country is uninhabited, nor is it frequented during the rains. We consequently found that the roads had suffered, the little bridges and aids to climb precipices and cross landslips had been carried away, and at one place we were all but turned back. This was at the Taktoong river, a tributary on the east bank, which rushes down at an angle of 15°, in a sheet of silvery foam, eighteen yards broad. It does not, where I crossed it, flow in a deep gulley, having apparently raised its bed by an accumulation of enormous boulders; and a plank bridge was thrown across it, against whose slippery and narrow foot-boards the water dashed, loosening the supports on either bank, and rushing between their foundation stones.

My unwilling guide had gone ahead with some of the coolies: I had suspected him all along (perhaps unjustly) of avoiding the most practicable routes; but when I found him waiting for me at this bridge, to which he sarcastically pointed with his bow, I felt that had he known of it, to have made difficulties before would have been a work of supererogation. He seemed to think I should certainly turn back, and assured me there was no other crossing (a statement I afterwards found to be untrue); so, comforting myself with the hope that if the danger were imminent, Meepo would forcibly stop me, I took off my shoes, and walked steadily over: the tremor of the planks was like that felt when standing on the paddle-box of a steamer, and I was jerked up and down, as my weight pressed them into the boiling flood, which shrouded me with spray. I looked neither to the right nor to the left, lest the motion of the swift waters should turn my head, but kept my eye on the white jets d'eau springing up between the woodwork, and felt thankful when fairly on the

[1] *Polygonum cymosum*, Wall. This is a common Himalayan plant, and is also found in the Khasia mountains.

opposite bank: my loaded coolies followed, crossing one by one without fear or hesitation. The bridge was swept into the Lachen very shortly afterwards.

Towards Lamteng, the path left the river, and passed through a wood of *Abies Smithiana*.[1] Larch appears at 9,000 feet, with *Abies Brunoniana*. An austere crab-apple, walnut, and the willow of Babylon (the two latter perhaps cultivated), yellow jessamine and ash, all scarce trees in Sikkim, are more or less abundant in the valley, from 7,000 to 8,000 feet; as is an ivy, very like the English, but with fewer and smaller yellow or reddish berries; and many other plants,[2] not found at equal elevations on the outer ranges of the Himalaya.

Chateng, a spur from the lofty peak of Tukcham,[3] 19,472 feet high, rises 1,000 feet above the west bank of the river; and where crossed, commands one of the finest alpine views in Sikkim. It was grassy, strewed with hugh boulders of gneiss, and adorned with clumps of park-like pines: on the summit was a small pool, beautifully fringed with bushy trees of white rose, a white-blossomed apple, a *Pyrus* like *Aria*, another like mountain-ash, scarlet rhododendrons (*arboreum* and *barbatum*), holly, maples, and *Goughia*,[4] a curious evergreen laurel-like tree: there were also Daphnes, purple magnolia, and a pink sweet-blossomed *Sphærostema*. Many English water-plants[5] grew in the water, but I found no shells; tadpoles, however, swarmed, which later in the season became large frogs. The "painted-lady" butterfly

[1] Also called *A. Khutrow* and *Morinda*. I had not before seen this tree in the Himalaya: it is a spruce fir, much resembling the Norway spruce in general appearance, but with longer pendulous branches. The wood is white, and considered indifferent, though readily cleft into planks; it is called "Seh."

[2] Wood-sorrel, a white-stemmed bramble, birch, some maples, nut, gigantic lily (*Lilium giganteum*), *Euphorbia*, *Pedicularis*, *Spiræa*, *Philadelphus*, *Deutzia*, *Indigofera*, and various other South Europe and North American genera.

[3] "Tuk" signifies head in Lepcha, and "cheam" or "chaum," I believe, has reference to the snow. The height of Tukcham has been re-calculated by Capt. R. Strachey, with angles taken by myself, at Darjeeling and Jillapahar, and is approximate only.

[4] This fine plant was named (Wight, "Ic. Plant.") in honour of Capt. Gough, son of the late commander-in-chief, and an officer to whom the botany of the peninsula of India is greatly indebted. It is a large and handsome evergreen, very similar in foliage to a fine rhododendron, and would prove an invaluable ornament on our lawns, if its hardier varieties were introduced into this country. [Now known as *Daphniphyllum Himalayense*.]

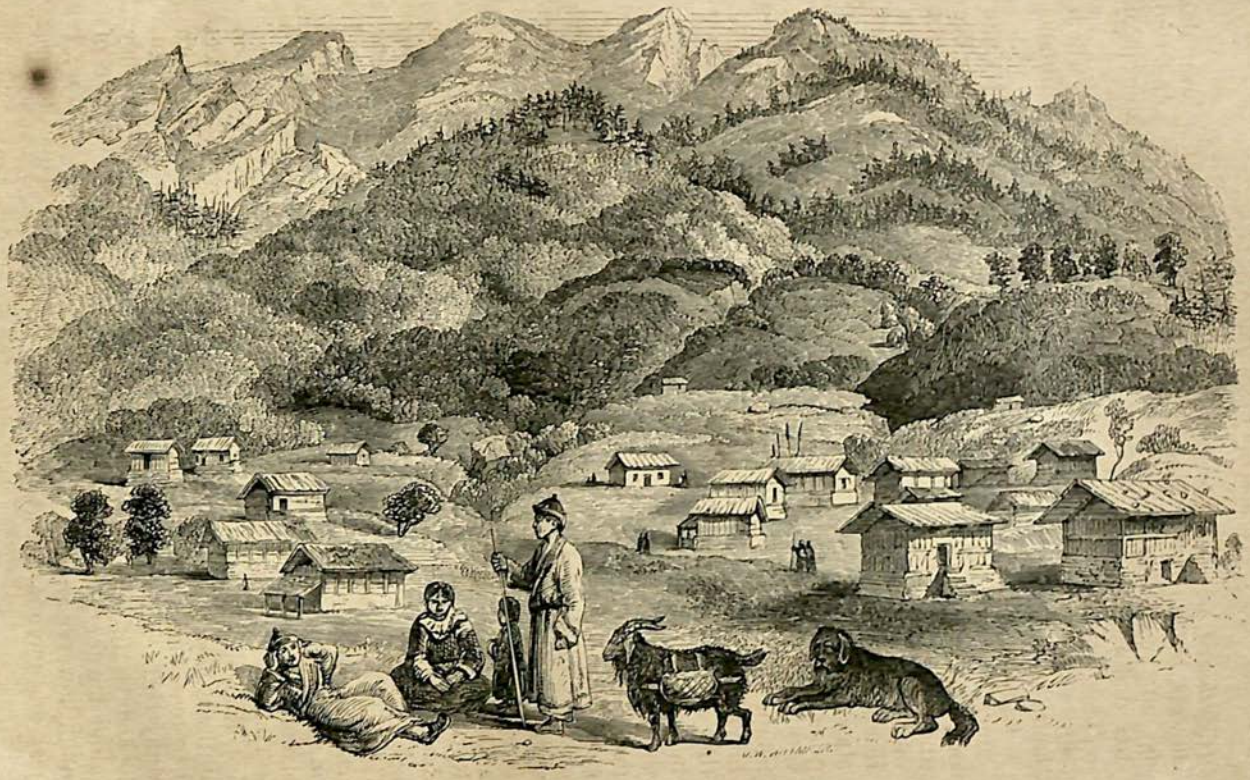
[5] *Sparganium*, *Typha*, *Potamogeton*, *Callitriche*, *Utricularia*, sedges and rushes.

(*Cynthia Cardui*), and a pretty "blue" were flitting over the flowers, together with some great tropical kinds, that wander so far up these valleys, accompanying *Marlea*, the only sub-tropical tree that ascends to 8,500 feet in the interior of Sikkim.

The river runs close under the eastern side of the valley, which slopes so steeply as to appear for many miles almost a continuous landslip, 2,000 feet high.

Lamteng village, where I arrived on the 27th of May, is quite concealed by a moraine to the south, which, with a parallel ridge on the north, forms a beautiful bay in the mountains, 8,900 feet above the sea, and 1,000 above the Lachen. The village stands on a grassy and bush flat, around which the pine-clad mountains rise steeply to the snowy peaks and black cliffs which tower above. It contains about forty houses, forming the winter-quarters of the inhabitants of the valley, who, in summer, move with their flocks and herds to the alpine pastures of the Tibet frontier. The dwellings are like those described at Wallanchoon, but the elevation being lower, and the situation more sheltered, they are more scattered; whilst on account of the dampness of the climate, they are raised higher from the ground, and the shingles with which they are tiled (made of *Abies Webbiana*) decay in two or three years. Many are painted lilac, with the gables in diamonds of red, black, and white: the roofs are either of wood, or of the bark of *Abies Brunoniana*, held down by large stones: within they are airy and comfortable. They are surrounded by a little cultivation of buck-wheat, radishes, turnips, and mustard. The inhabitants, though paying rent to the Sikkim Rajah, consider themselves as Tibetans, and are so in language, dress, features, and origin: they seldom descend to Choongtam, but yearly travel to the Tibetan towns of Jigatzi, Kambajong, Giantchi, and even to Lhassa, having always commercial and pastoral transactions with the Tibetans, whose flocks are pastured on the Sikkim mountains during summer, and who trade with the plains of India through the medium of these villagers.

The snow having disappeared from elevations below 11,000 feet, the yaks, sheep, and ponies had just been driven 2,000 feet up the valley, and the inhabitants were preparing to follow, with their tents and goats, to summer quarters at Tallum and Tungu. Many had goîtres and rheumatism, for the cure of which they flocked to my tent; dry-rubbing for the latter, and tincture of iodine for the former, gained me some credit as a doctor; I could, however, procure no food beyond trifling presents of eggs, meal, and more rarely, fowls.



LAMTENG VILLAGE.

On arriving, I saw a troop of large monkeys[1] gambolling in a wood of *Abies Brunoniana:* this surprised me, as I was not prepared to find so tropical an animal associated with a vegetation typical of a boreal climate. The only other quadrupeds seen here were some small earless rats, and musk-deer, the young female of which latter sometimes afforded me a dish of excellent venison; being, though dark-coloured and lean, tender, sweet, and short-fibred. Birds were scarce, with the exception of alpine pigeons (*Columba leuconota*), red-legged crows (*Corvus graculus*, L.), and the horned pheasant (*Meleagris Satyra*, L.). In this month insects are scarce, *Elater* and a black earwig being the most frequent; two species of *Serica* also flew into my tent, and at night two moths, closely resembling European ones, came from the fir-woods. The vegetation in the neighbourhood of Lamteng is European and North American; that is to say, it unites the boreal and temperate floras of the east and west hemispheres; presenting also a few features peculiar to Asia. This is a subject of very great importance in physical geography; as a country combining the botanical characters of several others, affords materials for tracing the direction in which genera and species have migrated, the causes that favour their migrations, and the laws that determine the types or forms of one region, which represent those of another. A glance at the map will show that Sikkim is, geographically, peculiarly well situated for investigations of this kind, being centrally placed, whether as regards south-eastern Asia or the Himalayan chain. Again, the Lachen valley at this spot is nearly equi-distant from the tropical forests of the Terai and the sterile mountains of Tibet, for which reason representatives both of the dry central Asiatic and Siberian, and of the humid Malayan floras meet there.

The mean temperature of Lamteng (about 50°) is that of the isothermal which passes through Britain in lat. 52°, and east Europe in lat. 48°, cutting the parallel of 45° in Siberia (due north of Lamteng itself), descending to lat. 42° on the east coast of Asia, ascending to lat. 48° on the west of America, and descending to that of New York in the United States. This mean temperature is considerably increased by descending to the bed of the Lachen at 8,000 feet, and diminished by ascending Tukcham to 14,000 feet, which gives a range of 6,000 feet of elevation, and 20° of mean temperature. But as the climate and vegetation become arctic at 12,000 feet, it will be as well to

[1] *Macacus Pelops?* Hodgson. This is a very different species from the tropical kind seen in Nepal, and mentioned at p. 195.

confine my observations to the flora of 7,000 to 10,000 feet; of the mean temperature, namely, between 53° and 43° degrees, the isothermal lines corresponding to which embrace, on the surface of the globe, at the level of the sea, a space varying in different meridians from three to twelve degrees of latitude.[1] At first sight it appears incredible that such a limited area, buried in the depths of the Himalaya, should present nearly all the types of the flora of the north temperate zone; not only, however, is this the case, but space is also found at Lamteng for the intercalation of types of a Malayan flora, otherwise wholly foreign to the north temperate region.

A few examples will show this. Amongst trees the Conifers are conspicuous at Lamteng, and all are of genera typical both of Europe and North America: namely, silver fir, spruce, larch, and juniper, besides the yew: there are also species of birch, alder, ash, apple, oak, willow, cherry, bird-cherry, mountain-ash, thorn, walnut, hazel, maple, poplar, ivy, holly, Andromeda, *Rhamnus*. Of bushes: rose, berberry, bramble, rhododendron, elder, cornel, willow, honeysuckle, currant, *Spiræa*, *Viburnum*, *Cotoneaster*, *Hippophae*. Herbaceous plants[2] are far too numerous to be enumerated, as a list would include most of the common genera of European and North American plants.

Of North American genera, not found in Europe, were *Buddleia*, *Podophyllum*, *Magnolia*, *Sassafras*? *Tetranthera*, *Hydrangea*, *Diclytra*, *Aralia*, *Panax*, *Symplocos*, *Trillium*, and *Clintonia*. The absence of heaths is also equally a feature in the flora of North America. Of European genera, not found in North America, the Lachen valley has *Coriaria*, *Hypecoum*, and various *Cruciferæ*. The Japanese and Chinese floras are represented in Sikkim by *Camellia*, *Deutzia*, *Stachyurus*, *Aucuba*, *Helwingia*, *Stauntonia*, *Hydrangea*, *Skimmia*, *Eurya*, *Anthogonium*, and *Enkianthus*. The Malayan by Magnolias, *Talauma*, many vacciniums and rhododendrons, *Kadsura*, *Goughia*, *Marlea*, both coriaceous and deciduous-leaved *Cœlogyne*, *Oberonia*, *Cyrtosia*, *Calanthe*, and other orchids; *Ceropegia*, *Parochetus*, *Balanophora*,

[1] On the west coast of Europe, where the distance between these isothermal lines is greatest, this belt extends almost from Stockholm and the Shetlands to Paris.

[2] As an example, the ground about my tent was covered with grasses and sedges, amongst which grew primroses, thistles, speedwell, wild leeks, *Arum*, *Convallaria*, *Callitriche*, *Oxalis*, *Ranunculus*, *Potentilla*, *Orchis*, *Chærophyllum*, *Galium*, *Paris*, and *Anagallis*; besides cultivated weeds of shepherd's purse, dock, mustard, Mithridate cress, radish, turnip, *Thlaspi arvense*, and *Poa annua*.

and many *Scitamineæ*; and amongst trees, by *Engelhardtia*, *Gonghia*, and various laurels.

Shortly after my arrival at Lamteng, the villagers sent to request that I would not shoot, as they said it brought on excessive rain,[1] and consequent damage to the crops. My necessities did not admit of my complying with their wish unless I could procure food by other means; and I at first paid no attention to their request. The people, however, became urgent, and the Choongtam Lama giving his high authority to the superstition, it appeared impolitic to resist their earnest supplication; though I was well aware that the story was trumped up by the Lama for the purpose of forcing me to return. I yielded on the promise of provisions being supplied from the village, which was done to a limited extent; and I was enabled to hold out till more arrived from Darjeeling, now, owing to the state of the roads, at the distance of twenty days' march. The people were always civil and kind: there was no concealing the fact that the orders were stringent, prohibiting my party being supplied with food, but many of the villagers sought opportunities by night of replenishing my stores. Superstitious and timorous, they regard a doctor with great veneration; and when to that is added his power of writing, drawing, and painting, their admiration knows no bounds: they flocked round my tent all day, scratching their ears, lolling out their tongues, making a clucking noise, smiling, and timidly peeping over my shoulder, but flying in alarm when my little dog resented their familiarity by snapping at their legs. The men spend the whole day in loitering about, smoking, and spinning wool: the women in active duties; a few were engaged in drying the leaves of a shrub (*Symplocos*) for the Tibet market, which are used as a yellow dye; whilst, occasionally, a man might be seen cutting a spoon or a yak-saddle out of rhododendron wood.

During my stay at Lamteng, the weather was all but uniformly cloudy and misty, with drizzling rain, and a southerly, or up-valley wind, during the day, which changed to an easterly one at night: occasionally distant thunder was heard. My rain-gauges showed very little rain compared with what fell at Darjeeling during the same period; the clouds were thin, both sun and moon shining through them, without, however, the former warming the soil: hence my tent was constantly wet, nor did I once sleep in a dry bed till the 1st of June, which ushered in the

[1] In Griffith's narrative of "Pemberton's Mission to Bhotan" ("Posthumous Papers, Journal," (p. 283), it is mentioned that the Gylongs (Lamas) attributed a violent storm to the members of the mission shooting birds,

month with a brilliant sunny day. At night it generally rained in torrents, and the roar of landslips and avalanches was then all but uninterrupted for hour after hour: sometimes it was a rumble, at others a harsh grating sound, and often accompanied with the crashing of immense timber-trees, or the murmur of the distant snowy avalanches. The amount of denudation by atmospheric causes is here quite incalculable; and I feel satisfied that the violence of the river at this particular part of its course (where it traverses those parts of the valleys which are most snowy and rainy), is proximately due to impediments thus accumulated in its bed.

It was sometimes clear at sunrise, and I made many ascents of Tukcham, hoping for a view of the mountains towards the passes; but I was only successful on one occasion, when I saw the table top of Kinchinjhow, the most remarkable, and one of the most distant peaks of dazzling snow which is seen from Darjeeling, and which, I was told, is far beyond Sikkim, in Tibet.[1] I kept up a constant intercourse with Choongtam, sending my plants thither to be dried, and gradually reducing my party as our necessities urged my so doing; lastly, I sent back the shooters, who had procured very little, and whose occupation was now gone.

On the 2nd of June, I received the bad news that a large party of coolies had been sent from Darjeeling with rice, but that being unable or afraid to pass the landslips, they had returned: we had now no food except a kid, a few handfuls of flour, and some potatoes, which had been sent up from Choongtam. All my endeavours to gain information respecting the distance and position of the frontier were unavailing; probably, indeed, the Lama and Phipun (or chief man of the village) were the only persons who knew; the villagers calling all the lofty pastures a few marches beyond Lamteng "Bhote" or "Cheen" (Tibet). Dr. Campbell had procured for me information by which I might recognise the frontier were I once on it; but no description could enable me to find my way in a country so rugged and forest-clad, through tortuous and perpetually forking valleys, along often obliterated paths, and under cloud and rain. To these difficulties must be added the deception of the rulers, and the fact (of which I was not then aware) that the Tibet frontier was formerly at Choongtam; but from the Lepchas constantly harassing the

[1] Such, however, is not the case; Kinchinjhow is on the frontier of Sikkim, though a considerable distance behind the most snowy of the Sikkim mountains.

Tibetans, the latter, after the establishment of the Chinese rule over their country, retreated first to Zemu Samdong, a few hours' walk above Lamteng, then to Tallum Samdong, 2,000 feet higher; and, lastly, to Kongra Lama, 16,000 feet up the west flank of Kinchinjhow.

On the third of June I took a small party, with my tent, and such provisions as I had, to explore up the river. On hearing of my intention, the Phipun volunteered to take me to the frontier, which he said was only two hours distant, at Zemu Samdong, where the Lachen receives the Zemu river from the westward: this I knew must be false, but I accepted his services, and we started, accompanied by a large body of villagers, who eagerly gathered plants for me along the road.

The scenery is very pretty; the path crosses extensive and dangerous landslips, or runs through fine woods of spruce and *Abies Brunoniana*, and afterwards along the river-banks, which are fringed with willow (called "Lama"), and *Hippophae*. The great red rose (*Rosa macrophylla*), one of the most beautiful Himalayan plants, whose single flowers are as large as the palm of the hand, was blossoming, while golden *Potentillas* and purple primroses flowered by the stream, and *Pyrola* in the fir-woods.

Just above the fork of the valley, a wooden bridge (Samdong) crosses the Zemu, which was pointed out to me as the frontier, and I was entreated to respect two sticks and a piece of worsted stretched across it; this I thought too ridiculous, so as my followers halted on one side, I went on the bridge, threw the sticks into the stream, crossed, and asked the Phipun to follow; the people laughed, and came over: he then told me that he had authority to permit of my botanising there, but that I was in Cheen, and that he would show me the guard-house to prove the truth of his statement. He accordingly led me up a steep bank to an extensive broad flat, several hundred feet above the river, and forming a triangular base to the great spur which, rising steeply behind, divides the valley. This flat was marshy and covered with grass; and buried in the jungle were several ruined stone houses, with thick walls pierced with loopholes: these had no doubt been occupied by Tibetans at the time when this was the frontier.

The elevation which I had attained (that of the river being 8,970 feet) being excellent for botanising, I camped; and the villagers, contented with the supposed success of their strategy, returned to Lamteng.

My guide from the Durbar had stayed behind at Lamteng, and

though Meepo and all my men well knew that this was not the frontier, they were ignorant as to its true position, nor could we even ascertain which of the rivers was the Lachen.[1] The only routes I possessed indicated two paths northwards from Lamteng, neither crossing a river: and I therefore thought it best to remain at Zemu Samdong till provisions should arrive. I accordingly halted for three days, collecting many new and beautiful plants, and exploring the roads, of which five (paths or yak-tracks) diverged from this point, one on either bank of each river, and one leading up the fork.

On one occasion I ascended the steep hill at the fork; it was dry and rocky, and crowned with stunted pines. Stacks of different sorts of pine-wood were stored on the flat at its base, for export to Tibet, all thatched with the bark of *Abies Brunoniana*. Of these the larch (*Larix Griffithii*, "Sah"), splits well, and is the most durable of any; but the planks are small, soft, and white.[2] The silver fir (*Abies Webbiana*, "Dunshing") also splits well; it is white, soft, and highly prized for durability. The wood of *Abies Brunoniana* ("Semadoong") is like the others in appearance, but is not durable; its bark is however very useful. The spruce (*Abies Smithiana*, "Seh") has also white wood, which is employed for posts and beams.[3] These are the only pines whose woods are considered very useful; and it is a curious circumstance that none produce any quantity of resin, turpentine, or pitch; which may perhaps be accounted for by the humidity of the climate.

Pinus longifolia (called by the Lepchas "Gniet-koong," and by the Boteeas "Teadong" only grows in low valleys, where better timber is abundant. The weeping blue juniper (*Juniperus recurva*, "Deschoo"), and the arboreous black one (called "Tchokpo"[4]) yield beautiful wood, like that of the pencil cedar,[5] but are comparatively scarce, as is the yew (*Taxus*

[1] The eastern afterwards proved to be the Lachen.

[2] I never saw this wood to be red, close-grained, and hard, like that of the old Swiss larch; nor does it ever reach so great a size.

[3] These woods are all soft and loose in grain, compared with their European allies.

[4] This I at the time supposed to be the *J. excelsa* of the north-west Himalaya, a plant which under various names is found in many parts of Europe and many parts of Europe and North America; but since Dr. Thomson and I have had occasion to compare my Sikkim conifers with the north-west Himalayan ones, we have found that this Sikkim species is probably new, and that *J. excelsa* is not found east of Nepal. [It is *J. pseudo-sabina*, a Siberian species.]

[5] Also a juniper, from Bermuda (*J. Bermudiana*).

baccata, "Tingschi"), whose timber is red. The "Tchenden," or funereal cypress, again, is valued only for the odour of its wood: *Pinus excelsa*, "Tongschi," though common in Bhotan, is, as I have elsewhere remarked, not found in east Nepal or Sikkim; the wood is admirable, being durable, close-grained, and so resinous as to be used for flambeaux and candles.

On the flat were flowering a beautiful magnolia with globular sweet-scented flowers like snow-balls, several balsams, with species of *Convallaria*, *Cotoneaster*, *Gentian*, *Spiræa*, *Euphorbia*, *Pedicularis*, and honeysuckle. On the hill-side were creeping brambles, lovely yellow, purple, pink, and white primroses, white-flowered *Thalictrum* and *Anemone*, berberry, *Podophyllum*, white rose, fritillary, *Lloydia*, &c. On the flanks of Tukcham, in the bed of a torrent, I gathered many very alpine plants, at the comparatively low elevation of 10,000 feet, as dwarf willows, *Pinguicula*, (a genus not previously found in the Himalaya), *Oxyria*, *Androsace*, *Tofieldia*, *Arenaria*, saxifrages, and two dwarf heath-like *Andromedas*.[1] The rocks were all of gneiss, with granite veins, tourmaline, and occasionally pieces of pure plumbago.

Our guide had remained at Lamteng, on the plea of a sore on his leg from leech-bites: his real object, however, was to stop a party on their way to Tibet with madder and canes, who, had they continued their journey, would inevitably have pointed out the road to me. The villagers themselves now wanted to proceed to the pasturing-grounds on the frontier; so the Phipun sent me word that I might proceed as far as I liked up the east bank of the Zemu. I had explored the path, and finding it practicable, and likely to intersect a less frequented route to the frontier (that crossing the Tekonglah pass from Bah, see p. 298), I determined to follow it. A supply of food arrived from Darjeeling on the 5th of June, reduced, however, to one bag of rice, but with encouraging letters, and the assurance that more would follow at once. My men, of whom I had eight, behaved admirably, although our diet had for five days chiefly consisted of *Polygonum* ("Pullopbi"), wild leeks ("Lagook"), nettles and *Procris* (an allied, and

[1] Besides these, a month later, the following flowered in profusion: scarlet *Buddleia?* gigantic lily, yellow jasmine, *Aster*, *Potentilla*, several kinds of orchids, willow-herb (*Epilobium*), purple *Roscoea*, *Neillia*, *Morina*, many grasses and *Umbelliferæ*. These formed a rank and dense herbaceous, mostly annual vegetation, six feet high, bound with *Cuscuta*, climbing *Leguminosæ*, and *Ceropegia*. The great summer heat and moisture here favour the ascent of various tropical genera, of which I found in August several *Orchideæ* (*Calanthe*, *Microstylis*, and *Cœlogyne*), also *Begonia*, *Bryonia*, *Cynanchum*, *Aristolochia*, *Eurya*, *Procris*, *Acanthaceæ*, *Cyrtandraceæ*.

more succulent herb), eked out by eight pounds of Tibet meal ("Tsamba"), which I had bought for ten shillings by stealth from the villagers. What concerned me most was the destruction of my plants by constant damp, and the want of sun to dry the papers; which reduced my collections to a tithe of what they would otherwise have been.

From Zemu Samdong the valley runs north-west, for two marches, to the junction of the Zemu with the Thlonok, which rises on the north-east flank of Kinchinjunga: at this place I halted for several days, while building a bridge over the Thlonok. The path runs first through a small forest of birch, alder, and maple, on the latter of which I found *Balanophora*[1] growing abundantly: this species produces the great knots on the maple roots, from which the Tibetans form the cups mentioned by MM. Huc and Gabet. I was so fortunate as to find a small store of these knots, cleaned, and cut ready for the turner, and hidden behind a stone by some poor Tibetan, who had never returned to the spot: they had evidently been there a very long time.

In the ravines there were enormous accumulations of ice, the result of avalanches; one of them crossed the river, forming a bridge thirty feet thick, at an elevation of only 9,800 feet above the sea. This ice-bridge was 100 yards broad, and flanked by heaps of boulders, the effects of combined land and snowslips. These stony places were covered with a rich herbage of rhubarb, primroses, *Euphorbia*, *Sedum*, *Polygonum*, *Convallaria*, and a purple *Dentaria* "Kenroop-bi") a cruciferous plant much eaten as a pot-herb. In the pine-woods a large mushroom ("Onglau,"[2] Tibet.) was abundant, which also forms a favourite article of food. Another pot-herb (to which I was afterwards more indebted than any) was a beautiful *Smilacina*, which grows from two to five feet high, and has plaited leaves and crowded panicles of white bell-shaped flowers, like those of its ally the lily of the valley, which it also resembles in its mucilaginous properties. It is called "Chokli-bi,"[3] and its young flower-heads, sheathed in tender green leaves, form an excellent vegetable. Nor must I forget to include amongst the eatable plants of this hungry country,

[1] A curious leafless parasite, mentioned at p. 91.

[2] *Cortinarius Emodensis* of the Rev. M. J. Berkeley, who has named and described it from my specimens and drawings. It is also called "Yungla tchamo" by the Tibetans, the latter word signifying a toadstool. Mr. Berkeley informs me that the whole vast genus *Cortinarius* scarcely possesses a single other edible species; he adds that *C. violaceus* and *violaceo-cinereus* are eaten in Austria and Italy, but not always with safety.

[3] It is also found on the top of Sinchul, near Darjeeling.

young shoots of the mountain-bamboo, which are good either raw or boiled, and may be obtained up to 12,000 feet in this valley. A species of *Asarum* (Asarabacca) grows in the pine-woods; a genus not previously known to be Himalayan. The root, like its English medicinal congener, has a strong and peculiar smell. At 10,000 feet *Abies Webbiana* commences, with a close undergrowth of a small twiggy holly. This, and the dense thicket of rhododendron[1] on the banks of the river and edges of the wood, rendered the march very fatiguing, and swarms of midges kept up a tormenting irritation.

The Zemu continued an impetuous muddy torrent, whose hoarse voice, mingled with the deep grumbling noise[2] of the boulders rolling along its bed, was my lullaby for many nights. Its temperature at Zemu Samdong was 45° to 46° in June. At its junction with the Thlonok, it comes down a steep gulley from the north, foreshortened into a cataract 1,000 feet high, and appearing the smaller stream of the two; whilst the Thlonok winds down from the snowy face of Kinchinjunga, which is seen up the valley, bearing W.S.W., about twenty miles distant. All around are lofty and rocky mountains, sparingly wooded with pines and larch, chiefly on their south flanks, which receive the warm, moist, up-valley winds; the faces exposed to the north being colder and more barren: exactly the reverse of what is the case at Choongtam, where the rocky and sunny south-exposed flanks are the driest.

My tent was pitched on a broad terrace, opposite the junction of the Zemu and Thlonok, and 10,850 feet above the sea. It was sheltered by some enormous transported blocks of gneiss, fifteen feet high, and surrounded by a luxuriant vegetation of most beautiful rhododendrons in full flower, willow, white rose, white-flowered cherry, thorn, maple and birch. Some great tuberous-rooted *Arums*[3] were very abundant; and the ground

[1] Of which I had already gathered thirteen kinds in this valley.

[2] The dull rumbling noise thus produced is one of the most singular phenomena in these mountains, and cannot fail to strike the observer. At night, especially, the sound seems increased, the reason of which is not apparent, for in these regions, so wanting in animal life, the night is no stiller than the day, and the melting of snow being less, the volume of waters must be somewhat, though not conspicuously, diminished. The interference of sound by heated currents of different density is the most obvious cause of the diminished reverberation during the day, to which Humboldt adds the increased tension of vapour, and possibly an echo from its particles.

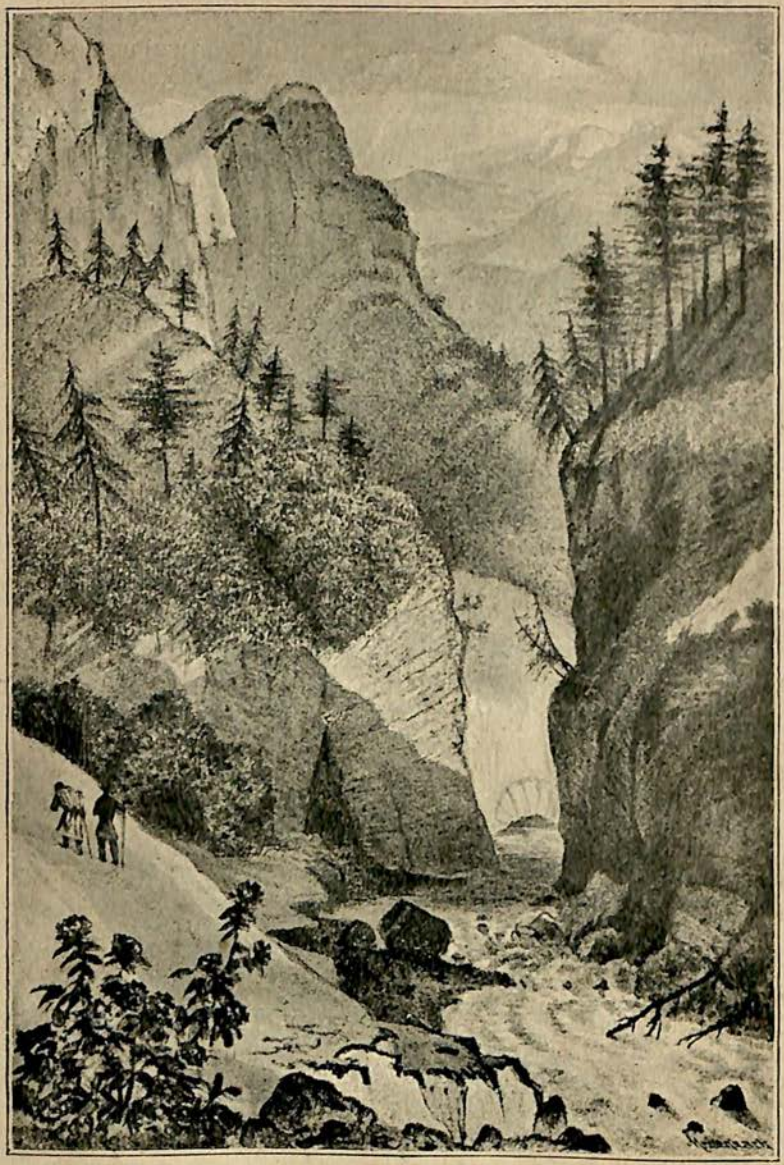
[3] Two species of *Arisæma*, called "Tong" by the Tibetans, and "Sinkree" by the Lepchas.

was covered with small pits, in which were large wooden pestles: these are used in the preparation of food from the arums, to which the miserable inhabitants of the valley have recourse in spring, when their yaks are calving. The roots are bruised with the pestles, and thrown into these holes with water. Acetous fermentation commences in seven or eight days, which is a sign that the acrid poisonous principle is dissipated: the pulpy, sour, and fibrous mass is then boiled and eaten; its nutriment being the starch, which exists in small quantities, and which they have not the skill to separate by grating and washing. This preparation only keeps a few days, and produces bowel complaints, and loss of the skin and hair, especially when insufficiently fermented. Besides this, the "chokli-bi," and many other esculents, abounded here; and we had great need of them before leaving this wild uninhabited region.

I repeatedly ascended the north flank of Tukcham along a watercourse, by the side of which were immense slips of rocks and snow-beds; the mountain-side being excessively steep. Some of the masses of gneiss thus brought down were dangerously poised on slopes of soft shingle, and daily moved a little downwards. All the rocks were gneiss and granite, with radiating crystals of tourmaline as thick as the thumb. Below 12,000 to 13,000 feet the mountain-sides were covered with a dense scrub of rhododendron bushes, except where broken by rocks, landslips, and torrents: above this the winter's snow lay deep, and black rocks and small glaciers, over which avalanches were constantly falling with a sullen roar, forbade all attempts to proceed. My object in ascending was chiefly to obtain views and compass-bearings, in which I was generally disappointed: once only I had a magnificent prospect of Kinchinjunga, sweeping down in one unbroken mass of glacier and ice, fully 14,000 feet high, to the head of the Thlonok river, whose upper valley appeared a broad bay of ice; doubtless forming one of the largest glaciers in the Himalaya, and increased by lateral feeders that flow into it from either flank of the valley. The south side of this (the Thlonok) valley is formed by a range from Kinchinjunga, running east to Tukcham, where it terminates: from it rises the beautiful mountain Liklo,[1] 22,582 feet high, which, from Darjeeling, appears as

[1] D[2] of the peaks laid down in Colonel Waugh's "Trigonometrical Survey from Darjeeling," I believe to be the "Liklo" of Dr. Campbell's itineraries from Darjeeling to Lhassa, compiled from the information of the traders (See "Bengal Asiatic Society's Journal" for 1848); the routes in which proved of the utmost value to me.

BOMBAY BRANCH
ROYAL ASIATIC SOCIETY
JACKSON
COLLECTION.



SNOW BEDS AT 13,000 FT. IN THE TH'LONOK VALLEY, WITH RHODODENDRONS; KINCHINJUNGA IN THE DISTANCE.

a sharp peak, but is here seen to be a jagged crest running north and south. On the north flank of the valley the mountains are more sloping and black, with patches of snow above 15,000 feet, but little anywhere else, except on another beautiful peak (alt. 19,240 feet) marked D^3 on the map. This flank is also continuous from Kinchin; it divides Sikkim from Tibet, and runs north-east to the great mountain Chomiomo (which was not visible), the streams from its north flank flowing into the Arun river (in Tibet). A beautiful blue arch of sky spanned all this range, indicating the dry Tibetan climate beyond.

I made two futile attempts to ascend the Thlonok river to the great glaciers at the foot of Kinchinjunga, following the south bank, and hoping to find a crossing-place, and so to proceed north to Tibet. The fall of the river is not great at this part of its course, nor up to 12,000 feet, which was the greatest height I could attain, and about eight miles beyond my tents; above that point, at the base of Liklo, the bed of the valley widens, and the rhododendron shrubbery was quite impervious, while the sides of the mountain were inaccessible. We crossed extensive snow-beds, by cutting holes in their steep faces, and rounded rocks in the bed of the torrent, dragging one another through the violent current, whose temperature was below 40°.

On these occasions, the energy of Meepo, Nimbo (the chief of the coolies) and the Lepcha boys, was quite remarkable, and they were as keenly anxious to reach the holy country of Tibet as I could possibly be. It was sometimes dark before we got back to our tents, tired, with torn clothes and cut feet and hands, returning to a miserable dinner of boiled herbs; but never did any of them complain, or express a wish to leave me. In the evenings and mornings they were always busy, changing my plants, and drying the papers over a sulky fire at my tent-door; and at night they slept, each wrapt in his own blanket, huddled together under a rock, with another blanket thrown over them all. Provisions reached us so seldom, and so reduced in quantity, that I could never allow more than one pound of rice to each man in a day, and frequently during this trying month they had not even that; and I eked out our meagre supply with a few ounces of preserved meats, occasionally "splicing the main brace" with weak rum and water.

At the highest point of the valley which I reached, water boiled at 191·3, indicating an elevation of 11,903 feet. The temperature at 1 P.M. was nearly 70°, and of the wet bulb 55°, indicating a dryness of 0·462, and dew point 47·0. Such phenomena of heat

and dryness are rare and transient in the wet valleys of Sikkim, and show the influence here of the Tibetan climate.[1]

After boiling my thermometer on these occasions, I generally made a little tea for the party; a refreshment to which they looked forward with child-like eagerness. The fairness with which these good-hearted people used to divide the scanty allowance, and afterwards the leaves, which are greatly relished, was an engaging trait in their simple character: I have still vividly before me their sleek swarthy faces and twinkling Tartar eyes, as they lay stretched on the ground in the sun, or crouched in the sleet and snow beneath some sheltering rock; each with his little polished wooden cup of tea, watching my notes and instruments with curious wonder, asking. "How high are we?" "How cold is it?" and comparing the results with those of other stations, with much interest and intelligence.

On the 11th June, my active people completed a most ingenious bridge of branches of trees, bound by withes of willow; by which I crossed to the north bank, where I camped on an immense flat terrace at the junction of the rivers, and about fifty feet above their bed. The first step or ascent from the river is about five feet high, and formed of water-worn boulders, pebbles, and sand, scarcely stratified: the second, fully 1,000 yards broad, is ten feet high, and swampy. The uppermost is fifteen feet above the second, and is covered with gigantic boulders, and vast rotting trunks of fallen pines, buried in an impenetrable jungle of dwarf small-leaved holly and rhododendrons. The surface was composed of a rich vegetable mould, which, where clear of forest, supported a rank herbage, six to eight feet high.[2]

[1] I gathered here, amongst an abundance of alpine species, all of European and arctic type, a curious trefoil, the *Parochetus communis*, which ranges through 9,000 feet of elevation on the Himalaya, and is also found in Java and Ceylon.

[2] This consisted of grasses, sedges, *Bupleurum*, rhubarb, *Ranunculus*, *Convallaria*, *Smilacina*, nettles, thistles, *Arum*, balsams, and the superb yellow *Meconopsis Nepalensis*, whose racemes of golden poppy-like flowers were as broad as the palm of the hand; it grows three and even six feet high, and resembles a small hollyhock; whilst a stately *Heracleum*, ten feet high, towered over all. Forests of silver fir, with junipers and larch, girdled these flats, and on their edges grew rhododendrons, scarlet *Spiræa*, several honeysuckles, white *Clematis*, and *Viburnum*. Ferns are much scarcer in the pine-woods than elsewhere in the forest regions of the Himalaya. In this valley (alt. 10,850 feet), I found only ten kinds; *Hymenophyllum*, *Lomaria*, *Cystopteris*, *Davallia*, two *Polypodia*, and several *Aspidia* and *Asplenia*. *Selaginella* ascends to Zemu Samdong (9,000 feet). The *Pteris aquilina* (brake) does not ascend above 10,000 feet.

Our first discovery, after crossing, was of a good bridge across the Zemu, above its junction, and of a path leading down to Zemu Samdong; this was, however, scarcely traceable up either stream. My men were better housed here in sheds: and I made several more ineffectual attempts to ascend the valley to the

BLACK JUNIPER (height sixty feet) AND YOUNG LARCH.
(See p. 318.)

glaciers. The path, gradually vanishing, ran alternately through fir-woods, and over open grassy spots, covered with vegetation, amongst which the gigantic arum was plentiful, whose roots seemed to be the only attraction in this wet and miserable valley.

On my return one day, I found my people in great alarm, the

Phipun having sent word that we were on the Tibet side of the rivers, and that Tibetan troops were coming to plunder my goods, and carry my men into slavery. I assured them he only wanted to frighten them; that the Cheen soldiers were civil orderly people; and that as long as Meepo was with us, there was no cause for fear. Fortunately a young musk-deer soon afterwards broke cover close to the tent, and its flesh wonderfully restored their courage: still I was constantly harassed by threats; some of my people were suffering from cold and bowel complaints, and I from rheumatism; while one fine lad, who came from Darjeeling, was delirious with a violent fever, contracted in the lower valleys, which sadly dispirited my party.

Having been successful in finding a path, I took my tent and a few active lads 1,000 feet up the Zemu, camping on a high rock above the forest region, at 12,070 feet, hoping thence to penetrate northwards. I left my collection in the interim at the junction of the rivers, where the sheds and an abundance of firewood were great advantages for preserving the specimens. At this elevation we were quite free from midges and leeches (the latter had not appeared above 11,500 feet), but the weather continued so uniformly rainy and bad, that we could make no progress. I repeatedly followed the river for several miles, ascending to 13,300 feet; but though its valley widened, and its current was less rapid, the rhododendron thickets below, and the cliffs above, defeated all endeavours to reach the drier climate beyond, of which I had abundant evidence in the arch of brilliant blue that spanned the heavens to the north, beyond a black canopy of clouds that hid everything around, and poured down rain without one day's intermission, during the eight which I spent here.

CHAPTER XX.

Camp on Zemu river—Scenery—Falling rocks—Tukcham mountain—Height of glaciers—Botany—Gigantic rhubarb—Insects—Storm—Temperature of rivers—Behaviour of Lachen Phipun—Hostile conduct of Bhoteeas—View from mountains above camp—Descend to Zemu Samdong—Vegetation—Letters from Darjeeling—Arrival of Singtam Soubah—Presents from Rajah—Parties collecting Arum-roots—Insects—Ascend Lachen river—Thakya-zong—Tallum Samdong village—Cottages—Mountains—Plants—Entomology—Weather—Halo—Diseases—Conduct of Singtam Soubah—His character and illness—Agrees to take me to Kongra Lama—Tungu—Appearance of country—Houses—Poisoning by arum-roots—Yaks and calves—Tibet ponies—Journey to Kongra Lama—Tibetan tents—Butter, curds, and churns—Hospitality—Kinchinjhow and Chomiomo—Magnificent Scenery—Reach Kongra Lama Pass.

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little tent was pitched in a commanding situation, on a rock feet above the Zemu, overlooking the course of that river to nction with the Thlonok. The descent of the Zemu in one nd feet is more precipitous than that of any other river of with which I am acquainted in Sikkim, yet immediately my camp it was more tranquil than at any part of its course ds to the plains of India, whether as the Zemu, Lachen or a. On the west bank a fine mountain rose in steep ridges shrubby banks to 15,000 feet; on the east a rugged cliff ed above the stream, and from this, huge masses of rock ever and anon precipitated into the torrent, with a roar that tedly spread consternation amongst us. During rains ially, and at night, when the chilled atmospheric currents descend, and the sound is not dissipated as in the day-time, oise of these falls is sufficiently alarming. My tent was d near the base of the cliff, and so high above the river, I had thought it beyond the reach of danger; but one ing I found that a large fragment of granite had been hurled g the night to my very door, my dog having had a very w escape. To what depth the accumulation at the base of liff may reach, I had no means of judging, but the rapid of the river-bed is mainly due to this, and to old moraines e mouth of the valley below. I have seen few finer sights the fall of these stupendous blocks into the furious torrent, which they are carried amid feathery foam for many yards settling to rest.

Across the Thlonok to the southwards, rose the magnificent mountain of Tukcham, but I only once caught a glimpse of its summit, which even then clouded over before I could get my

instruments adjusted for ascertaining its heigh[illegible] cone, surrounded by rocky shoulders, that [illegible] from a mass of snow. Its eastern slope of 8,000 feet is very rapid (about 38°) from its base at the Zemu river to its summit.

Glaciers in the north-west Himalaya descend to 11,000 feet, but I could not discover any in these valleys even so low as 14,000 feet, though at this season extensive snow-beds remain unmelted at but little above 10,000 feet. The foot of the stupendous glacier filling the broad head of the Thlonok is certainly not below 14,000 feet; though being continuous with the perpetual snow (or névé) of the summit of Kinchinjunga, it must have 14,000 feet of ice, in perpendicular height, to urge it forwards.

All my attempts to advance up the Zemu were fruitless, and a snow bridge by which I had hoped to cross to the opposite bank was carried away by the daily swelling river, while the continued bad weather prevented any excursions for days together. Botany was my only resource, and as vegetation was advancing rarvest: under the influence of the southerly winds, I had a rich ha[illegible] finer for though *Compositæ*, *Pedicularis*, and a few more of th[illegible] Himalayan plants flower later, June is still the most [illegible] month for show.

Rhododendrons occupy the most prominent place, el[illegible] bells the mountain slopes with a deep green mantle glowing with every of brilliant colours; of the eight or ten species growing here [illegible] bush was loaded with as great a profusion of blossoms [illegible] their northern congeners in our English gardens. Primrose are next, both in beauty and abundance; and they are accompanied by yellow cowslips, three feet high, purple polyanthus, and pink large-flowered dwarf kinds nestling in the rocks, and an exquisitely beautiful blue miniature species, whose blossoms sparkle like sapphires on the turf. Gentians begin to unfold their deep azure bells, aconites to rear their tall blue spikes, and fritillaries, and *Meconopsis* burst into flower. On the black rocks the gigantic rhubarb [*Rheum nobile*] forms pale pyramidal towers a yard high, of inflated reflexed bracts, that conceal the flowers, and overlapping one another like tiles, protect them from the wind and rain: a whorl of broad green leaves edged with red spreads on the ground at the base of the plant, contrasting in colour with the transparent bracts, which are yellow, margined with pink. This is the handsomest herbaceous plant in Sikkim: it is called "Tchuka," and the acid stems are eaten both raw and boiled; they are hollow and full of pure water: the root resembles that of the medicinal rhubarb, but it is spongy and inert; it attains a length of four

feet, and grows as thick as the arm. The dried leaves afford a substitute for tobacco; a smaller kind of rhubarb is however more commonly used in Tibet for this purpose: it is called "Chula."

The elevation being 12,080 feet, I was above the limit of trees, and the ground was covered with many kinds of small-flowered honeysuckles, berberry, and white rose.[1]

I saw no birds, and of animals only an occasional musk-deer. Insects were scarce, and quite different from what I had seen before, chiefly consisting of *Phryganeæ* (Mayfly) and some *Carabidæ* (an order that is very scarce in the Himalaya); with various moths, chiefly *Geometræ*.

The last days of June (as is often the case) were marked by violent storms, and for two days my tent proved no protection; similar weather prevailed all over India, the barometer falling very low. I took horary observations of the barometer in the height of the storm on the 30th: the tide was very small indeed (.024 inch, between 9.50 A.M. and 4 P.M.), and the thermometer ranged between 47° and 57°8, between 7 A.M. and midnight. Snow fell abundantly as low as 13,000 feet, and the rivers were much swollen, the size and number of the stones they rolled along producing a deafening turmoil. Only 3.7 inches of rain fell between the 23rd of June and the 2nd of July; whilst 21 inches fell at Darjeeling, and 6.7 inches at Calcutta. During the same period the mean temperature was 48°; extremes, $\frac{62°\cdot0}{36°\cdot5}$. The humidity was nearly at saturation-point, the wind southerly, very raw and cold, and drizzling rain constantly fell. A comparison of thirty observations with Darjeeling gave a difference of 14° temperature, which is at the rate of 1° for every 347 feet of ascent.[2]

The temperature of these rivers varies extremely at different

[1] Besides these I found a prickly *Aralia*, maple, two currants, eight or nine rhododendrons, many *Sedums*, *Rhodiola*, white *Clematis*, red-flowered cherry, birch, willow, *Viburnum*, juniper, a few ferns, two *Andromedas*, *Menziesia*, and *Spiræa*. And in addition to the herbs mentioned above may be enumerated *Parnassia*, many Saxifrages, *Soldanella*, *Draba*, and various other *Cruciferæ*, *Nardostachys* (spikenard), *Epilobium*, *Thalictrum*, and very many other genera, almost all typical of the Siberian, North European, and Arctic floras.

[2] Forty-seven observations, comparative with Calcutta, gave 34° 8 difference, and if 5°5 of temperature be deducted for northing in latitude, the result is 1° for every 412 feet of ascent. My observations at the junction of the rivers (alt. 10,850 feet), during the early part of the month, gave 1° to 304 feet, as the result of twenty-four observations with Darjeeling, and 1° to 394 feet, from seventy-four observations with Calcutta.

parts of the course, depending on that of their affluents. The Teesta is always cool in summer (where its bed is below 2,000 feet), its temperature being 20° below that of the air; whereas in mid-winter, when there is less cloud, and the snows are not melting, it is only a few degrees colder than the air.[1] At this season, in descending from 12,000 feet to 1,000 feet, its temperature does not rise 10°, though that of the air rises 30° or 40°. It is a curious fact, that the temperature of the northern feeders of the Teesta, in some parts of their course, rises with the increasing elevation! Of this the Zemu afforded a curious example: during my stay at this junction with the Thlonok it was 46°, or 6° warmer than that river; at 1,100 feet higher it was 49°! These observations were repeated in different weeks, and several times on the same day, both in ascending and descending, and always with the same result: they told, as certainly as if I had followed the river to its source, that it rose in a drier and comparatively sunny climate, and flowed amongst little snowed mountains.

Meanwhile, the Lachen Phipun continued to threaten us, and I had to send back some of the more timorous of my party. On the 28th of June fifty men arrived at the Thlonok, and turned my people out of the shed at the junction of the rivers, together with the plants they were preserving, my boards, papers, and utensils. The boys came to me breathless, saying that there were Tibetan soldiers amongst them, who declared that I was in Chéen, and that they were coming on the following morning to make a clean sweep of my goods and drive me back to Darjeeling. I had little fear for myself, but was anxious with respect to my collections: it was getting late in the day, and raining, and I had no mind to go down and expose myself to the first brunt of their insolence, which I felt sure a night of such weather would materially wash away. Meepo was too frightened, but Nimbo, my Bhotan coolie Sirdar, volunteered to go, with two stout fellows; and he accordingly brought away my plants and papers, having held a parley with the enemy, who, as I suspected, were not Tibetans. The best news he brought was, that they were half clad and without food; the

[1] During my sojourn at Bhomsong in mid-winter of 1848 (see p. 214), the mean temperature of the Teesta was 51°, and of the air 52° 3; at that elevation the river water rarely exceeds 60° at midsummer. Between 4,000 feet and 300 (the plains) its mean temperature varies about 10° between January and July; at 6,000 feet it varies from 55° to 43° during the same period; and at 10,000 feet it freezes at the edges in winter and rises to 50° in July.

worst, that they swaggered and bullied: he added, with some pride, that he gave them as good as he got, which I could readily believe, Nimbo being really a resolute fellow,[1] and accomplished in Tibet slang.

On the following morning it rained harder than ever, and the wind was piercingly cold. My timid Lepchas huddled behind my tent, which, from its position, was only to be stormed in front. I dismantled my little observatory, and packed up the instruments, tied my dog, Kinchin, to one of the tent-pegs, placed a line of stones opposite the door, and seated myself on my bed on the ground, with my gun beside me.

The dog gave tongue as twenty or thirty people defiled up the glen, and gathered in front of my tent; they were ragged Bhoteas, with bare heads and legs, in scanty woollen garments sodden with rain, which streamed off their shaggy hair, and furrowed their sooty faces: their whole appearance recalled to my mind Dugald Dalgetty's friends, the children of the mist.

They appeared nonplussed at seeing no one with me, and at my paying no attention to them, whilst the valiant Kinchin effectually scared them from the tent-door. When they requested a parley, I sent the interpreter to say that I would receive three men, and that only provided all the rest were sent down immediately; this, as I anticipated was acceded to at once, and there remained only the Lachen Phipun and his brother. Without waiting to let him speak, I rated him soundly, saying that I was ready to leave the spot when he could produce any proof of my being in Bhote (or Cheen), which he knew well I was not; that, since my arrival at Lachen, he had told me nothing but lies, and had contravened every order, both of the Rajah and of Tchebu Lama. I added, that I had given him and his people kindness and medicine, their return was bad, and he must go about his business at once, having, as I knew, no food, and I having none for him. He behaved very humbly throughout, and finally took himself off much discomfited, and two days afterwards sent men to offer to assist me in moving my things.

The first of July was such a day as I had long waited for to obtain a view, and I ascended the mountain west of my camp, to a point where water boiling at 185°7 (air 42°), gave an elevation of 14,914 feet. On the top of the range, about 1,000 feet above this, there was no snow on the eastern exposures, except in hollows, but on the west slopes it lay in great fields twenty or

[1] In East Nepal he drew his knife on a Ghorka sepoy; and in the following winter was bold enough to make his escape in chains from Tumloong.

thirty feet thick; while to the north, the mountains all appeared destitute of snow, with grassy flanks and rugged tops.

Drizzling mist, which had shrouded Tukcham all the morning, soon gathered on this mountain, and prevented any prospect from the highest point reached; but on the ascent I had an excellent view up the Zemu, which opened into a broad grassy valley, where I saw with the glass some wooden sheds, but no cattle or people. To reach these, however, involved crossing the river, which was now impossible; and I reluctantly made up my mind to return on the morrow to Zemu Samdong, and thence try the other river.

On my descent to the Thlonok, I found that the herbaceous plants on the terraces had grown fully two feet during the fortnight, and now presented almost a tropical luxuriance and beauty. Thence I reached Zemu Samdong in one day, and found the vegetation there even more gay and beautiful: the gigantic lily was in full flower, and scenting the air, with the lovely red rose, called the "Chirring" by the Tibetans. *Neillia* was blossoming profusely at my old camping-ground, to which I now returned after a month's absence.

Soon after my arrival I received letters from Dr. Campbell, who had strongly and repeatedly represented to the Rajah his opinion of the treatment I was receiving; and this finally brought an explicit answer, to the effect that his orders had been full and peremptory that I should be supplied with provisions and safely conducted to the frontier. With these came letters on the Rajah's part from Tchebu Lama to the Lachen Phipun, ordering him to take me to the pass, but not specifying its position; fortunately, however, Dr. Campbell sent me a route, which stated the pass to be at Kongra Lama, several marches beyond this, and in the barren country of Tibet.

On the 5th of July the Singtam Soubah arrived from Chola (the Rajah's summer residence): he was charged to take me to the frontier, and brought letters from his highness, as well as a handsome present, consisting of Tibet cloth, and a dress of China silk brocaded with gold: the Ranee also sent me a basket of Lhassa sweetmeats, consisting of Sultana raisins from Bokhara, sliced and dried apricots from Lhassa, and *Diospyros* fruit from China (called "Gubroon" by the Tibetans). The Soubah wanted to hurry me on to the frontier and back at once, being no doubt instigated to do so by the Dewan's party, and by his having no desire to spend much time in the dreary lofty regions I wanted to explore. I positively refused, however, to

start until more supplies arrived, except he used his influence to provide me with food; and as he insisted that the frontier was at Tallum Samdong, only one march up the Lachen, I foresaw that this move was to be but one step forward, though in the right direction. He went forward to Tallum at once, leaving me to follow.

The Lamteng people had all migrated beyond that point to Tungu, where they were pasturing their cattle: I sent thither for food, and procured a little meal at a very high price, a few fowls and eggs; the messenger brought back word that Tungu was in Tibet, and that the villagers ignored Kongra Lama. A large piece of yak-flesh being brought for sale, I purchased it; but it proved the toughest meat I ever ate, being no doubt that of an animal that had succumbed to the arduous duties of a salt-carrier over the passes: at this season, however, when the calves are not a month old, it was in vain to expect better.

Large parties of women and children were daily passing my tent from Tungu, to collect arum-roots at the Thlonok, all with baskets at their backs, down to rosy urchins of six years old: they returned after several days, their baskets neatly lined with broad rhododendron leaves, and full of a nauseous-looking yellow acid pulp, which told forcibly of the extreme poverty of the people. The children were very fair; indeed the young Tibetan is as fair as an English brunette, before his perennial coat of smoke and dirt has permanently stained his face, and it has become bronzed and wrinkled by the scorching sun and rigorous climate of these inhospitable countries. Children and women were alike decked with roses, and were all good-humoured and pleasant, behaving with great kindness to one another, and unaffected politeness to me.

During my ten days' stay at Zemu Samdong, I formed a large collection of insects, which was in great part destroyed by damp: many were new, beautiful, and particularly interesting, from belonging to types whose geographical distribution is analogous to that of the vegetation. The caterpillar of the swallow-tail butterfly (*Papilio Machaon*) was common, feeding on umbelliferous plants, as in England; and a *Sphynx* (like *S. Euphorbiæ*) was devouring the euphorbias; the English *Cynthia Cardui* (painted-lady butterfly) was common, as were "sulphurs," "marbles," *Pontia* (whites), "blues," and *Thecla*, of British aspect but foreign species. Amongst these, tropical forms were rare, except one fine black swallow-tail. Of moths, *Noctuæ* and *Geometræ* abounded, with many flies and *Tipulæ*. *Hymenoptera* were

scarce, except a yellow *Ophion*, which lays its eggs in the caterpillars above-mentioned. Beetles were most rare, and (what is remarkable) the wood-borers (*longicorns* and *Curculio*) particularly so. A large *Telephora* was very common, and had the usual propensity of its congeners for blood: *lamellicorns* were also abundant.

On the 11th of July five coolies arrived with rice: they had been twenty days on the road, and had been obliged to make great detours, the valley being in many places impassable. They brought me a parcel of English letters; and I started up the Lachen on the following day, with renewed spirits and high hopes. The road first crossed the Zemu and the spur beyond, and then ascended the west bank of the Lachen, a furious torrent for five or six miles, during which it descends 1,000 feet, in a chasm from which rise lofty black pine-clad crags, topped by snowy mountains, 14,000 to 16,000 feet high. One remarkable mass of rock, on the east bank, is called "Sakya-zong" (or the abode of Sakya, often pronounced Thakya, one of the Boodhist Trinity); at its base a fine cascade falls into the river.

Above 11,000 feet the valley expands remarkably, the mountains recede, become less wooded, and more grassy, while the stream is suddenly less rapid, meandering in a broader bed, and bordered by marshes, covered with *Carex*, *Blysmus*, dwarf Tamarisk, and many kinds of yellow and red *Pedicularis*, both tall and beautiful. There are far fewer rhododendrons here than in the damper Zemu valley at equal elevations, and more Siberian, or dry country types of vegetation, as *Astragali* of several kinds, *Habenaria*, *Epipactis*, dandelion, and a caraway, whose stems (called in Tibet "Gzira") are much sought for as a condiment.[1] The Singtam Soubah and Lachen Phipun received me at the bridge (Samdong), at Tallum, and led me across the river (into Cheen they affirmed) to a pretty green sward, near some gigantic gneiss boulders, where I camped, close by the river, and 11,480 feet above the sea.

The village of Tallum consists of a few wretched stone huts, placed in a broad part of the valley, which is swampy, and crossed by several ancient moraines, which descend from the gulleys on

[1] *Umbelliferæ* abound here; with sage, *Ranunculus*, *Anemone*, Aconites, *Halenia*, Gentians, *Panax*, *Euphrasia*, speedwell, *Prunella vulgaris*, thistles, bistort, *Parnassia*, purple orchis, *Prenanthes*, and *Lactuca*. The woody plants of this region are willows, birch, *Cotoneaster*, maple, three species of *Viburnum*, three of *Spiræa*, *Vaccinium*, *Aralia*, *Deutzia*, *Philadelphus*, rhododendrons, two junipers, silver fir, larch, three honeysuckles, *Neillia*, and a *Pieris*, whose white blossoms are so full of honey as to be sweet and palatable.

the east flank.[1] The cottages are from four to six feet high, without windows, and consist of a single apartment, containing neither table, chair, stool, nor bed; the inmates huddle together amid smoke, filth, and darkness, and sleep on a plank; and their only utensils are a bamboo churn, copper, bamboo, and earthenware vessels, for milk, butter, &c.

Grassy or stone mountains slope upwards, at an angle of 20°,[2] from these flats to 15,000 feet, but no snow is visible, except on Kinchinjhow and Chomiomo, about fifteen miles up the valley. Both these are flat-topped, and dazzling white, rising into small peaks, and precipitous on all sides; they are grand, bold, isolated masses, quite unlike the ordinary snowy mountains in form, and far more imposing even than Kinchinjunga, though not above 22,000 feet in elevation.

Herbaceous plants are much more numerous here than in any other part of Sikkim; and sitting at my tent-door, I could, without rising from the ground, gather forty-three plants,[3] of which all but two belonged to English genera. In the rich soil about the cottages were crops of dock, shepherd's-purse, *Thlaspi arvense*, *Cynoglossum* of two kinds (one used as a pot-herb), balsams, nettle, *Galeopsis*, mustard, radish, and turnip. On the neighbouring hills, which I explored up to 15,000 feet, I found many fine plants, partaking more or less of the Siberian type, of which *Corydalis*, *Leguminosæ*, *Artemisia*, and *Pedicularis*, are familiar instances. I gathered upwards of 200 species, nearly all belonging to north European genera. Twenty-five were woody shrubs above three feet high, and six were ferns;[4] sedges were in great profusion, amongst them three of British kinds: seven or eight were *Orchidæ*, including a fine *Cypripedium*.

The entomology of Tallum, like its botany, was Siberian, Arctic types occurring at lower elevations than in the wetter parts of Sikkim. Of beetles the honey-feeding ones prevailed, with

[1] I have elsewhere noticed that in Sikkim, the ancient moraines about 9,000 feet are almost invariably deposited from valleys opening to the westward.

[2] At Lamteng and up the Zemu the slopes are 40° and 50°, giving a widely different aspect to the valleys.

[3] In England thirty is, on the average, the equivalent number of plants, which in favourable localities I have gathered in an equal space. In both cases many are seedlings of short-lived annuals, and in neither is the number a test of the luxuriance of the vegetation; it but shows the power which the different species exert in their struggle to obtain a place.

[4] *Cryptogramma crispa*, *Davallia*, two *Aspidia*, and two *Polypodia*. I gathered *ten* at the same elevation, in the damper Zemu valley (see p. 49, *note*). I gathered in this valley a new species of the remarkable European genus *Struthiopteris*, which has not been found elsewhere in the Himalaya.

European forms of others that inhabit yak-droppings.[1] Bees were common, both *Bombus* and *Andræna*, but there were no wasps, and but few ants. Grasshoppers and other *Orthoptera* were rare, as were *Hemiptera*; *Tipula* was the common dipterous insect, with a small sand-fly: there were neither leeches, mosquitos, ticks, nor midges. Pigeons, red-legged crows, and hawks were the common birds; with a few waders in the marshes.

Being now fairly behind most of the great snow and rain-collecting mountains, I experienced a considerable change in climate, which characterises all these rearward lofty valleys, where very little rain falls, and that chiefly drizzle; but this is so constant that the weather feels chilly, raw, and comfortless, and I never returned dry from botanising. The early mornings were bright with views northwards of blue sky and Kinchinjhow, while to the south the lofty peak of Tukcham, though much nearer, was seldom seem, and black cumuli and nimbi rolled up the steep valley of the Lachen to be dissipated in mist over Tallum. The sun's rays were, however, powerful at intervals during the afternoon, whence the mean maximum temperature of July occurred at about 10 A.M. The temperature of the river was always high, varying with the heat of the day from 47° to 52°; the mean being 50°.

These streams do not partake of the diurnal rise and fall, so characteristic of the Swiss rivers and those of the western Himalaya, where a powerful sun melts the glaciers by day, and their head-streams are frozen by night. Here the clouds alike prevent solar and nocturnal radiation, the temperature is more uniform, and the corroding power of the damp southerly wind that blows strongly throughout the day is the great melting agent. One morning I saw a vivid and very beautiful halo 20° degrees distant from the sun's disc; it was no doubt caused by snow in the higher regions of the atmosphere, as a sharp shower of rain fell immediately afterwards; these are rare phenomena in mountainous countries.

The Singtam Soubah visited me daily, and we enjoyed long friendly conversations: he still insisted that the Yangchoo (the name he gave to the Lachen at this place) was the boundary, and that I must not go any further. His first question was always

[1] As *Aphodius* and *Geotrupes*. Predaceous genera were very rare, as *Carabus* and *Staphylinus*, so typical of boreal regions. *Coccinella* (lady-bird), which swarms at Darjeeling, does not ascend so high, and a *Clytus* was the only longicorn. *Buprestis*, *Elater*, and *Blaps* were found but rarely. Of butterflies, the *Machaon* seldom reaches this elevation, but the painted-lady, *Pontia*, *Colias*, *Hipparchia*, *Argynnis*, and *Polyommatus*, are all found.

"How long do you intend to remain here? have you not got all the plants and stones you want? you can see the sun much better with those brasses and glasses [1] lower down; it is very cold here, and there is no food:"—to all which I had but one reply, that I should not return till I had visited Kongra Lama. He was a portly man, and, I think, at heart good-natured: I had no difficulty in drawing him on to talk about Tibet, and the holy city of Teshoo Loombo, with its thousands of gilt temples, nunneries, and convents, its holiest of all the holy grand Lamas of Tibet, and all the wide Boodhist world besides. Had it even been politic, I felt it would be unfair to be angry with a man who was evidently in a false position between myself and his two rulers, the Rajah and Dewan; who had a wife and family on the smiling flanks of Singtam, and who longed to be soaking in the warm rain of Sikkim, drinking Murwa beer (a luxury unknown amongst these Tibetans) and gathering in his crops of rice, millet, and buck-wheat. Though I may owe him a grudge for his subsequent violence, I still recall with pleasure the hours we spent together on the banks of the Lachen. In all matters respecting the frontier, his lies were circumstantial; and he further took the trouble of bringing country people to swear that this was Cheen, and that there was no such place as Kongra Lama. I had written to ask Dr. Campbell for a definite letter from Tchebu Lama on this point, but unfortunately my despatches were lost; the messenger who conveyed them missed his footing in crossing the Lachen, and escaped narrowly with life, while the turban in which the letters were placed was carried down the current.

Finally the Soubah tried to persuade my people that one so incorrigibly obstinate must be mad, and that they had better leave me. One day, after we had had a long discussion about the geography of the frontier, he inflamed my curiosity by telling me that Kinchinjhow was a very holy mountain; more so than its sister-peaks of Chumulari and Kinchinjunga; and that both the Sikkim and Tibetan Lamas, and Chinese soldiers, were ready to oppose my approach to it. This led to my asking him for a sketch of the mountains; he called for a large sheet of paper, and some charcoal, and wanted to form his mountains of sand; I however ordered rice to be brought, and though we had but little, scattered it about wastefully. This had its effect; he stared at my wealth, for he had all along calculated on starving me out, and retired, looking perplexed and crestfallen. Nothing puzzled

[1] Alluding to the sextant, &c.

him so much as my being always occupied with such, to him, unintelligible pursuits; a Tibetan "cui bono?" was always in his mouth: "What good will it do *you?*" "Why should you spend weeks on the coldest, hungriest, windest, loftiest place on the earth, without even inhabitants?" Drugs and idle curiosity he believed were my motives, and possibly a reverence for the religion of Boodh, Sakya, and Tsongkaba. Latterly he had made up his mind to starve me out, and was dismayed when he found I could hold out better than himself, and when I assured him that I should not retrace my steps until his statements should be verified by a letter from Tchebu; that I had written to him, and that it would be at least thirty days before I could receive an answer.

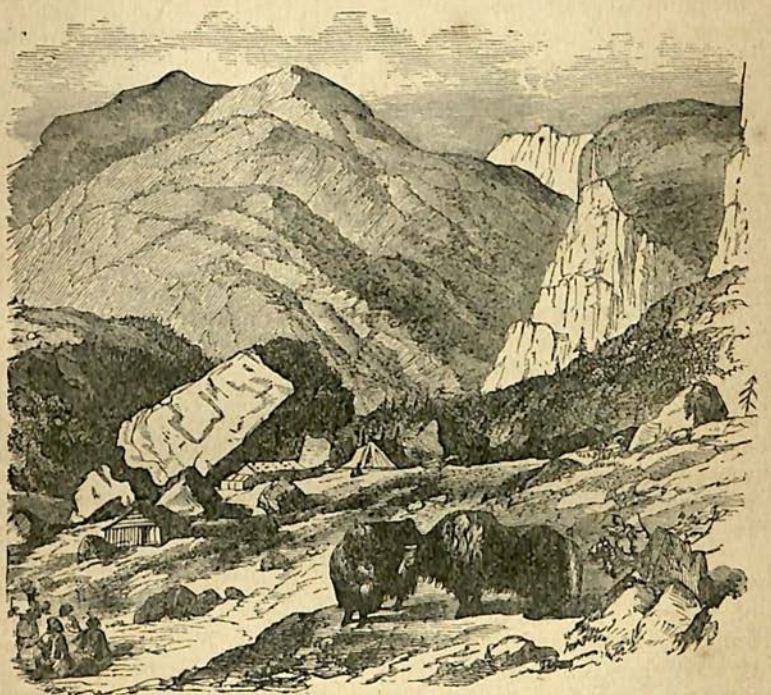
On the 19th of July he proposed to take me to Tungu, at the foot of Kinchinjhow, and back, upon ponies, provided I would leave my people and tent, which I refused to do. After this I saw little of him for several days, and began to fear he was offended, when one morning his attendant came to me for medicine with a dismal countenance, and in great alarm: he twisted his fingers together over his stomach to symbolise the nature of the malady which produced a commotion in his master's bowels, and which was simply the colic. I was aware that he had been reduced to feed upon "Tong" (the arum-root) and herbs, and had always given him half the pigeons I shot, which was almost the only animal food I had myself. Now I sent him a powerful dose of medicine; adding a few spoonfuls of China tea and sugar for friendship.

On the 22nd, being convalescent, he visited me, looking wofully yellow. After a long pause, during which he tried to ease himself of some weighty matter, he offered to take me to Tungu with my tent and people, and thence to Kongra Lama, if I would promise to stay but two nights. I asked whether Tungu was in Cheen or Sikkim; he replied that after great enquiry he had heard that it was really in Sikkim; "Then," said I, "we will both go to-morrow morning to Tungu, and I will stay there as long as I please:" he laughed, and gave in with apparent good grace.

After leaving Tallum, the valley contracts, passing over great ancient moraines, and again expanding wider than before into broad grassy flats. The vegetation rapidly diminishes in stature and abundance, and though the ascent to Tungu is trifling, the change in species is very great. The *Spiræa*, maple, *Pieris*, cherry, and larch disappear, leaving only willow, juniper, stunted birch, silver fir, white rose, *Aralia*, berberry, currant, and more rhodo-

dendrons than all these put together;[1] while mushrooms and other English fungi[2] grew amongst the grass.

Tungu occupies a very broad valley, at the junction of the Tungu-choo from the east, and the Lachen from the north. The hill slope gently upwards to 16,000 feet, at an average angle of 15°; they are flat and grassy at the base, and no snow is anywhere



TUNGU VILLAGE.

[1] *Cyananthus*, a little blue flower allied to *Campanula*, and one of the most beautiful alpines I know, covered the turfy ground, with *Orchis*, *Pedicularis*, *Gentian*, *Potentilla*, *Geranium*, purple and yellow *Meconopsis* and the *Artemisia* of Darjeeling, which ascends to 12,000 feet, and descends to the plains, having a range of 11,500 feet in elevation. Of ferns, *Hymenophyllum*, *Cistopteris*, and *Cryptogramma crispa* ascend thus high.

[2] One of great size, growing in large clumps, is the English *Agaricus comans*, Fr., and I found it here at 12,500 feet, as also the beautiful genus *Crucibulum*, which is familiar to us in England, growing on rotten sticks, and resembling a diminutive bird's nest with eggs in it.

to be seen.[1] A stupendous rock, about fifty feet high, lay in the middle of the valley, broken in two: it may have been detached from a cliff, or have been transported thither as part of an ancient moraine which extends from the mouth of the Tungu-choo valley across that of the Lachen. The appearance and position of this great block, and of the smaller piece lying beside it, rather suggest the idea of the whole mass having fallen perpendicularly from a great height through a *crevasse* in a glacier, than of its having been hurled from so considerable a distance as from the cliffs on the flanks of the valley: it is faithfully represented in the accompanying woodcut. A few wooden houses were collected near this rock, and several black tents were scattered about. I encamped at an elevation of 12,750 and was waited on by the Lachen Phipun with presents of milk, butter, yak-flesh, and curds; and we were not long before we drowned old enmity in buttered and salted tea.

On my arrival I found the villagers in a meadow, all squatted cross-legged in a circle, smoking their brass and iron pipes, drinking tea, and listening to a letter from the Rajah, concerning their treatment of me. Whilst my men were pitching my tent, I gathered forty plants new to me, all of Tartarian types.[2] Wheat or barley I was assured had been cultivated at Tungu when it was possessed by Tibetans, and inhabited by a frontier guard, but I saw no appearance of any cultivation. The fact is an important one, as barley required a mean summer temperature of 48° to come to maturity. According to my observations, the mean temperature of Tungu in July is upwards of 50°, and, by calculation, that of the three summer months, June, July, and August, should be about 46° 5. As, however, I do not know whether these cerealia were grown as productive crops, much stress cannot be laid upon the fact of their having been cultivated, for in a great many parts of Tibet the barley is annually cut green for fodder.

In the evening the sick came to me: their complaints, as usual, being rheumatism, ophthalmia, goitres, cuts, bruises, and poisoning

[1] In the wood-cut the summit of Chomiomo is introduced, as it appears from a few hundred feet above the point of view.

More Siberian plants appeared, as *Astragali*, *Chenopodium*, *Artemisia*, some grasses, new kinds of *Pedicularis*, *Delphinium*, and some small Orchids. Three species of *Parnassia* and six primroses made the turf gay, mixed with saxifrages, *Androsace* and *Campanula*. By the cottages was abundance of shepherd's-purse, *Lepidium*, and balsams, with dock, *Galeopsis* and *Cuscuta*. Several low dwarf species of honeysuckle formed stunted bushes like heather; and *Anisodus*, a curious plant allied to *Hyoscyamus*, whose leaves are greedily eaten by yaks, was very common.

by Tong (*Arum*), fungi, and other deleterious vegetables. At Tallum I attended an old woman who dressed her ulcers with *Plantago* (plantain) leaves, a very common Scotch remedy; the ribs being drawn out from the leaf, which is applied fresh: it is rather a strong application.

On the following morning I was awakened by the shrill cries of the Tibetan maidens, calling the yaks to be milked, "Toosh—toosh—toooosh," in a gradually higher key; to which Toosh seemed supremely indifferent, till quickened in her movements by a stone or stick, levelled with unerring aim at her ribs; these animals were changing their long winter's wool for sleek hair, and the former hung about them in ragged masses, like tow. Their calves gambolled by their sides, the drollest of animals, like ass-colts in their antics, kicking up their short hind-legs, whisking their bushy tails in the air, rushing up and down the grassy slopes, and climbing like cats to the top of the rocks.

The Soubah and Phipun came early to take me to Kongra Lama, bringing ponies, genuine Tartars in bone and breed. Remembering the Dewan's impracticable saddle at Bhomsong, I stipulated for a horse-cloth or pad, upon which I had no sooner jumped than the beast threw back his ears, seated himself on his haunches, and, to my consternation, slid backwards down a turfy slope, pawing the earth with his fore-feet as he went, and leaving me on the ground, amid shrieks of laughter from my Lepchas. My steed being caught, I again mounted, and was being led forward, when he took to shaking himself like a dog till the pad slipped under his belly, and I was again unhorsed. Other ponies displayed equal prejudices against my mode of riding, or having my weight anywhere but well on their shoulders, being all-powerful in their fore-quarters; and so I was compelled to adopt the high demi-pique saddle with short stirrups, which forced me to sit with my knees up to my nose, and to grip with the calves of my legs and heels. All the gear was of yak or horse-hair, and the bit was a curb and ring, or a powerful twisted snaffle.

The path ran N.N.W. for two miles, and then crossed the Lachen above its junction with the Nunee[1] from the west: the stream was rapid, and twelve yards in breadth; its temperature was 48°. About six miles above Tungu, the Lachen is joined by the Chomio-choo, a large affluent from Chomiomo mountain. Above this the Lachen meanders along a broad stony bed, and

[1] I suspect there is a pass by the Nunee to the sheds I saw up the Zemu valley on the 2nd of July, as I observed yaks grazing high up the mountains: the distance cannot be great, and there is little or no snow to interfere.

the path rises over a great ancient moraine, whose level top is covered with pools, but both that and its south face are bare, from exposure to the south wind, which blows with fury through this contracted part of the valley to the rarified atmosphere of the lofty, open, and dry country beyond. Its north slope, on the contrary, is covered with small trees and brushwood, rhododendron, birch, honeysuckle, and mountain-ash. These are the most northern shrubs in Sikkim, and I regarded them with deep interest, as being possibly the last of their kind to be met with in this meridian, for many degrees further north: perhaps even no similar shrubs occur between this and the Siberian Altai, a distance of 1,500 miles. The magnificent yellow cowslip (*Primula Sikkimensis*) gilded the marshes, and *Caltha*,[1] *Trollius*, Anemone, *Arenaria*, *Draba*, Saxifrages, Potentillas, Ranunculus, and other very alpine plants abounded.

At the foot of the moraine was a Tibetan camp of broad, black, yak-hair tents, stretched out with a complicated system of ropes, and looking at a distance—(to borrow M. Huc's graphic simile) —like fat-bodied, long-legged spiders! Their general shape is hexagonal, about twelve feet either way, and they are stretched over six short posts, and encircled with a low stone wall, except in front. In one of them I found a buxom girl, the image of good humour, making butter and curd from yak-milk. The churns were of two kinds; one being an oblong box of birch-bark, or close bamboo wicker-work, full of branched rhododendron twigs, in which the cream is shaken: she good-naturedly showed me the inside, which was frosted with snow-white butter, and alive with maggots. The other churn was a goat-skin, which was rolled about, and shaken by the four legs. The butter is made into great squares, and packed in yak-hair cloths; the curd is eaten either fresh, or dried and pulverised (when it is called "Ts'cheuzip").

Except bamboo and copper milk-vessels, wooden ladles, tea-churn, and pots, these tents contained no furniture but goat-skins and blankets, to spread on the ground as a bed. The fire was made of sheep and goats'-droppings, lighted with juniper-wood; above it hung tufts of yaks'-hair, one for every animal lost during the season,[2] by which means a reckoning is kept. Although this

[1] This is the *C. scaposa*, n. sp. The common *Caltha palustris*, or "marsh marigold" of England, which is not found in Sikkim, is very abundant in the north-west Himalaya.

[2] The Siberians hang tufts of horse-hair inside their houses from superstitious motives (Ermann's "Siberia," i., 281).

girl had never before seen a European, she seemed in no way discomposed at my visit, and gave me a large slice of fresh curd.

Beyond this place (alt. 14,500 feet), the valley runs up north-east, becoming very stony and desolate, with green patches only by the watercourses: at this place, however, thick fogs came on, and obscured all view. At 15,000 feet, I passed a small glacier on the west side of the valley, the first I had met with that descended nearly to the river, during the whole course of the Teesta.

Five miles further on we arrived at the tents of the Phipun, whose wife was prepared to entertain us with Tartar hospitality: magnificent tawny Tibet mastiffs were baying at the tent-door, and some yaks and ponies were grazing close by. We mustered twelve in number, and squatted cross-legged in a circle inside the tent, the Soubah and myself being placed on a pretty Chinese rug. Salted and buttered tea was immediately prepared in a tea-pot for us on the mat, and in a great caldron for the rest of the party; parched rice and wheat-flour, curd, and roasted maize[1] were offered us, and we each produced our wooden cup, which was kept constantly full of scalding tea-soup, which, being made with fresh butter, was very good. The flour was the favourite food, of which each person dexterously formed little dough-balls in his cup, an operation I could not well manage, and only succeeded in making a nauseous paste, that stuck to my jaws and in my throat. Our hostess' hospitality was too *exigeant* for me, but the others seemed as if they could not drink enough of the scalding tea.

We were suddenly startled from our repast by a noise like loud thunder, crash following crash, and echoing through the valley. The Phipun got up, and coolly said, "The rocks are falling, it is time we were off, it will rain soon." The moist vapours had by this time so accumulated, as to be condensed in rain on the cliffs of Chomiomo and Kinchinjhow; which, being loosened, precipitated avalanches of rocks and snow. We proceeded amidst dense fog, soon followed by hard rain; the roar of falling rocks on either hand increasing as these invisible giants spoke to one another in voices of thunder through the clouds. The effect was indescribably grand: and as the weather cleared, and I obtained transient peeps of their precipices of blue ice and black rock

[1] Called "pop-corn" in America, and prepared by roasting the maize in an iron vessel, when it splits and turns partly inside out, exposing a snow-white spongy mass of farina. It looks very handsome, and would make a beautiful dish for dessert.

towering 5,000 feet above me on either hand, the feeling of awe produced was almost overpowering. Heavy banks of vapour still veiled the mountains, but the rising mist exposed a broad stony track, along which the Lachen wandered, split into innumerable channels, and enclosing little oases of green vegetation, lighted up by occasional gleams of sunshine. Though all around was enveloped in gloom, there was in front a high blue arc of cloudless sky, between the beetling cliffs that formed the stern portals of the Kongra Lama pass.

CHAPTER XXI.

Top of Kongra Lama — Tibet frontier—Elevation—View—Vegetation—Descent to Tungu—Tungu-choo—Ponies—Kinchinjhow and Changokhang mountains—Palung plains—Tibetans—Dogs—Dingcham province of Tibet—Inhabitants—Dresses—Women's ornaments—Blackening faces—Coral — Tents—Elevation of Palung — Lama — Shawl-wool goats—Shearing—Siberian plants—Height of glaciers, and perpetual snow—Geology—Plants, and wild animals—Marmots—Insects—Birds—Choongtam Lama — Religious exercises — Tibetan hospitality — *Delphinium*—Perpetual snow—Temperature at Tungu—Return to Tallum Samdong—To Lamteng—Houses—Fall of Barometer—Cicadas—Lime deposit—Landslips—Arrival at Choongtam—Cobra—Rageu—Heat of Climate—Velocity and volume of rivers measured—Leave for Lachoong valley—Keadom—General features of valley—Lachoong village—Tunkra mountain — Moraines — Cultivation — Lachoong Phipun — Lama ceremonies beside a sick-bed.

WE reached the boundary between Sikkim and Tibet early in the afternoon; it is drawn along Kongra Lama, which is a low flat spur running east from Kinchinjhow towards Chomiomo, at a point where these mountains are a few miles apart, thus crossing the Lachen river:[1] it is marked by cairns of stone, some rudely fashioned into chaits, covered with votive rags on wands of bamboo. I made the altitude by barometer 15,745 feet above the sea, and by boiling water, 15,694 feet, the water boiling at 184.1°; the temperature of the air between 2.40 and 4 P.M. varied from 41° 3 to 42° 5, the dew-point 39·8°; that of the Lachen was 47°, which was remarkably high. We were bitterly cold; as the previous rain had wetted us through, and a keen

[1] The upper valley of the Lachen in Tibet, which I ascended in the following October, is very open, flat, barren, and stony; it is bounded on the north by rounded spurs from Chomiomo, which are continued east to Donkia, forming a watershed to the Lachen on the south, and to the Arun on the north.

wind was blowing up the valley. The continued mist and fog intercepted all view, except of the flanks of the great mountains on either hand, of the rugged snowy ones to the south, and of those bounding the Lachen to the north. The latter were unsnowed, and appeared lower than Kongra Lama, the ground apparently sloping away in that direction; but when I ascended them, three months afterwards, I found they were 3,000 feet higher! a proof how utterly fallacious are estimates of height, when formed by the eye alone. My informants called them Peuka-t'hlo; "peu" signifies north in Tibetan, and "t'hlo" a hill in Lepcha.

Isolated patches of vegetation appeared on the top of the pass, where I gathered forty kinds of plants, most of them being of a tufted habit characteristic of an extreme climate; some (as species of *Caryophylleæ*) forming hemispherical balls on the naked soil; others [1] growing in matted tufts level with the ground. The greater portion had no woolly covering; nor did I find any of the cottony species of *Saussurea*, which are so common on the wetter mountains to the southward. Some most delicate-flowered plants even defy the biting winds of these exposed regions; such are a prickly *Meconopsis* with slender flower-stalks and four large blue poppy-like petals, a *Cyananthus* with a membranous bell-shaped corolla, and a fritillary. Other curious plants were a little yellow saxifrage with long runners (very like the arctic *S. flagellaris*, of Spitzbergen and Melville Island), and the strong-scented spikenard (*Nardostachys*).

The rocks were chiefly of reddish quartz, and so was the base of Chomiomo. Kinchinjhow on the contrary was of gneiss, with granite veins: the strike of both was north-west, and the dip north-east 20° to 30°.

We made a fire at the top with sheep's droppings, of which the Phipun had brought up a bagful, and with it a pair of goat-skin bellows, which worked by a slit that was opened by the hand in the act of raising; when inflated, the hole was closed, and the skin pressed down, thus forcing the air through the bamboo nozzle: this is the common form of bellows throughout Tibet and the Himalaya.

After two hours I was very stiff and cold, and suffering from headache and giddiness, owing to the elevation; and having

[1] The other plants found on the pass were; of smooth hairless ones, *Ranunculus*, Fumitory, several species of *Stellaria*, *Arenaria*, *Cruciferæ*, *Parnassia*, *Morina*, saxifrages, *Sedum*, primrose, *Herminium*, *Polygonum*, *Campanula*, *Umbelliferæ*, grasses and *Carices*: of woolly or hairy ones, *Anemone*, *Artemisia*, *Myosotis*, *Draba*, *Potentilla*, and several *Compositæ*, &c.

walked about thirteen miles botanising, I was glad to ride down. We reached the Phipun's tents about 6 P.M., and had more tea before proceeding to Tungu. The night was fortunately fine and calm, with a few stars and a bright young moon, which, with the glare from the snows, lighted up the valley, and revealed magnificent glimpses of the majestic mountains. As the moon sank, and we descended the narrowing valley, darkness came on, and with a boy to lead my sure-footed pony, I was at liberty uninterruptedly to reflect on the events of a day, on which I had attained the object of so many years' ambition. Now that all obstacles were surmounted, and I was returning laden with materials for extending the knowledge of a science which had formed the pursuit of my life, will it be wondered at that I felt proud, not less for my own sake, than for that of the many friends, both in India and at home, who were interested in my success?

We arrived at Tungu at 9 P.M., my pony not having stumbled once, though the path was rugged, and crossed by many rapid streams. The Soubah's little shaggy steed had carried his portly frame (fully fifteen stone weight) the whole way out and back, and when he dismounted, it shook itself, snorted, and seemed quite ready for supper.

On the following morning I was occupied in noting and arranging my collections, which consisted of upwards of 200 plants; all gathered above 14,000 feet elevation.[1] Letters arrived from Darjeeling with unusual speed, having been only seventeen days on the road: they were full of valuable suggestions and encouragement from my friends Hodgson, Campbell, and Tchebu Lama.

On the 26th of July the Phipun, who waited on me every morning with milk and butter, and whose civility and attentions were now unremitting, proposed that I should accompany him to an encampment of Tibetans, at the foot of Kinchinjhow. We mounted ponies, and ascended the Tunguchoo eastwards: it was a rapid river for the first thousand feet, flowing in a narrow gorge, between sloping, grassy, and rocky hills, on which large herds of yaks were feeding, tended by women and children, whose black tents were scattered about. The yak-calves left their mothers to run beside our ponies, which became unmanageable, being almost callous to the bit; and the whole party was sometimes careering

[1] Amongst them the most numerous Natural orders and genera were, *Cruciferæ* 10; *Compositæ* 20; *Ranunculaceæ* 10; *Alsineæ* 9; *Astragali* 10; *Potentillæ* 8; grasses 12; *Carices* 15; *Pedicularis* 7; *Boragineæ* 7.

over the slopes, chased by the grunting herds: in other places, the path was narrow and dangerous, when the sagacious animals proceeded with the utmost gravity and caution. Rounding one rocky spur, my pony stumbled, and pitched me forward: fortunately I lighted on the path.

The rocks were gneiss, with granite veins (strike north-east, dip south-east): they were covered with *Ephedra*,[1] an *Onosma* which yields a purple dye, *Orchis*, and species of *Androsace*; while the slopes were clothed with the spikenard and purple *Pediculāris*, and the moist grounds with yellow cowslip and long grass. A sudden bend in the valley opened a superb view to the north, of the full front of Kinchinjhow, extending for four or five miles east and west; its perpendicular sides studded with the immense icicles, which are said to have obtained for it the name of "jhow," —the "bearded" Kinchin. Eastward a jagged spur stretches south, rising into another splendid mountain, called Chango-khang (the Eagle's crag), from whose flanks descend great glaciers, the sources of the Tunguchoo.

We followed the course of an affluent, called the Chacoo, along whose bed ancient moraines rose in successive ridges: on these I found several other species of European genera.[2] Over one of these moraines, 500 feet high, the path ascends to the plains of Palung, an elevated grassy expanse, two miles long and four broad, extending southward from the base of Kinchinjhow. Its surface, though very level for so mountainous a country, is yet varied with open valleys and sloping hills, 500 to 700 feet high: it is bounded on the west by low rounded spurs from Kinchinjhow, that form the flank of the Lachen valley; while on the east it is separated from Chango-khang by the Chachoo, which cuts a deep east and west trench along the base of Kinchinjhow, and then turns south to the Tunguchoo. The course of the Chachoo, where it turns south, is most curious: it meanders in sickle-shaped curves along the marshy bottom of an old lake-bed, with steep shelving sides, 500 to 600 feet deep, and covered with juniper bushes.[3] It is fed by the glaciers of Kinchinjhow, and some little lakes to the east.

[1] A curious genus of small shrubs allied to pines, that grows in the south of Europe. This species is the European *E. vulgaris*; it inhabits the driest parts of north-west India, and ascends to 17,000 feet in Tibet, but is not found in the moist intervening countries.

[2] *Delphinium, Hypecoum, Sagina, Gymnandra, Artemisia, Caltha, Dracocephalum, Leontopodium.*

[3] These, which grow on an eastern exposure, exist at a higher elevation than any other bushes I have met with.

The mean height of Palung plains is 16,000 feet: they are covered with transported blocks, and I have no doubt their surface has been much modified by glacial action. I was forcibly reminded of them by the slopes of the Wengern Alp, but those of Palung are far more level. Kinchinjhow rises before the spectator, just as the Jungfrau, Mönch, and Eigher Alps do from that magnificent point of view.

On ascending a low hill, we came in sight of the Tibet camp at the distance of a mile, when the great mastiffs that guarded it

LEPCHA GIRLS (THE OUTER FIGURES), AND TIBETAN WOMEN.

immediately bayed; and our ponies starting off at full gallop, we soon reached an enclosure of stone dykes, within which the black tents were pitched. The dogs were of immense size, and ragged, like the yaks, from their winter coat hanging to their flanks in great masses; each was chained near a large stone, on and off which he leapt as he gave tongue; they are very savage, but great cowards, and not remarkable for intelligence.

The people were natives of Gearee and Kambajong, in the adjacent province of Dingcham, which is the loftiest, coldest, most windy and arid in Eastern Tibet, and in which are the sources

of all the streams that flow to Nepal, Sikkim, and Bhotan on the one side, and into the Yaru-tsampu on the other. These families repair yearly to Palung, with their flocks, herds, and tents, paying tribute to the Sikkim Rajah for the privilege: they arrive in June and leave in September. Both men and women were indescribably filthy; as they never wash, their faces were perfectly black with smoke and exposure, and the women's with a pigment of grease as a protection from the wind. The men were dressed as usual, in the blanket-cloak, with brass pipes, long knives, flint, steel, and amulets; the women wore similar, but shorter cloaks, with silver and copper girdles, trowsers, and flannel boots. Their head-dresses were very remarkable. A circular band of plaited yak's hair was attached to the back hair, and encircled the head like a saint's glory,[1] at some distance round it. A band crossed the forehead, from which coins, corals, and turquoises, hung down to the eyebrows, while lappets of these ornaments fell over the ears. Their own hair was plaited in two tails, brought over the shoulders, and fastened together in front; and a little yellow felt cap, traversely elongated, so as not to interfere with the shape of the glory, was perched on the head. Their countenances were pleasing, and their manners timid.

The children crawled half-naked about the tent, or burrowed like moles in an immense heap of goats' and sheep-droppings, piled up for fuel, upon which the family lounged. An infant in arms was playing with a "coral," ornamented much like ours, and was covered with jewels and coins. This custom of decorating children is very common amongst half-civilised people; and the coral is, perhaps, one of the last relics of a barbarous age that is retained amongst ourselves. One mother was nursing her baby, and churning at the same time, by rolling the goat-skin of yak-milk about on the ground. Extreme poverty induces the practice of nursing the children for years; and in one tent I saw a lad upwards of four years of age unconcernedly taking food from his aunt, and immediately afterwards chewing hard dry grains of maize.

The tents were pitched in holes about two feet and a half deep; and within them a wall of similar height was built all round: in the middle was a long clay arched fire-place, with holes

[1] I find in Ermann's "Siberia" (i., p. 210), that the married women of Yekaterinberg wear a head-dress like an ancient glory covered with jewels, whilst the unmarried ones plait their tresses. The same distinguished traveller mentions having seen a lad of six years old suckled, amongst the Tungooze of East Siberia.

above, over which the cauldrons were placed, the fire being underneath. Saddles, horse-cloths, and the usual accoutrements and implements of a nomade people, all of the rudest description, hung about: there was no bed or stool, but Chinese rugs for sleeping on. I boiled water on the fire-place; its temperature (184° 5) with that of the air (45° 5) gave an elevation of 15,867 feet. Barometric observations, taken in October, at a point considerably lower down the stream, made the elevation 15,620 feet, or a few feet lower than Kongra Lama pass.

A Lama accompanied this colony of Tibetans, a festival in honour of Kinchinjhow being annually held at a large chait hard by, which is painted red, ornamented with banners, and surmounted by an enormous yak's skull, that faces the mountain. The Lama invited me into his tent, where I found a wife and family. An extempore altar was at one end, covered with wafers and other pretty ornaments, made of butter, stamped or moulded with the fingers.[1] The tents being insupportably noisome, I preferred partaking of the buttered brick-tea in the open air; after which, I went to see the shawl-wool goats sheared in a pen close by. There are two varieties: one is a large animal, with great horns, called "Rappoo;"[2] the other smaller, and with slender horns, is called "Tsilloo." The latter yields the finest wool, but they are mixed for ordinary purposes. I was assured that the sheep (of which large flocks were grazing near) afford the finest wool of any. The animals were caught by the tail, their legs tied, the long winter's hair pulled out, and the remainder cut away with a broad flat knife, which was sharpened with a scythe-stone. The operation was clumsily performed, and the skin much cut.

Turnips are grown at Palung during the short stay of the people, and this is the most alpine cultivation in Sikkim: the seed is sown early in July, and the tubers are fit to be eaten in October, if the season is favourable. They did not come to maturity this year, as I found on again visiting this spot in October; but their tops had afforded the poor Tibetans some good vegetables. The mean temperature of the three summer months at Palung is probably about 40°; an element of comparatively little importance in regulating the growth and ripening of vegetables at great elevations in Tibetan climates; where a warm exposure, the

[1] The extensive use of these ornaments throughout Tibet, on the occasion of religious festivals, is alluded to by MM. Huc and Gabet.

[2] This is the "Changra," and the smaller the "Chyapu" of Mr. Hodgson's catalogue. (See "British Museum Catalogue.")

amount of sunshine, and of radiated heat, have a much greater influence.

During the winter, when these families repair to Kambajong, in Tibet, the flocks and herds are all stall-fed, with long grass, cut on the marshy banks of the Yaru. Snow is said to fall five feet deep at that place, chiefly after January; and it melts in April.

After tea, I ascended the hills overhanging the Lachen valley, which are very bare and stony; large flocks of sheep were feeding on them, chiefly upon small tufted sedges, allied to the English *Carex pilularis*, which here forms the greatest part of the pasture, the grass grows mixed with it in small tufts, and is the common Scotch mountain pasture-grass (*Festuca ovina*).

On the top of these hills, which, for barrenness, reminded me of the descriptions given of the Siberian steppes, I found, at 17,000 feet elevation, several minute arctic plants, with *Rhododendron nivale*, the most alpine of woody plants. On their sterile slopes grew a curious plant allied to the *Cherleria* of the Scotch Alps, forming great hemispherical balls on the ground, eight to ten inches across, altogether resembling in habit the curious Balsam-bog (*Bolax glebaria*) of the Falkland Islands, which grows in very similar scenes.[1]

A few days afterwards, I again visited Palung, with the view of ascertaining the height of perpetual snow on the south face of Kinchinjhow; unfortunately, bad weather came on before I

[1] *Arenaria rupifraga*, Fenzl. This plant is mentioned by Dr. Thomson ("Travels in Tibet," p. 426) as common in Tibet, as far north as the Karakoram, at an elevation between 16,000 and 18,000 feet. In Sikkim it is found at the same level. Specimens of it are exhibited in the Kew Museum. As one instance illustrative of the chaotic state of Indian botany, I may here mention that this little plant, a denizen of such remote and inaccessible parts of the globe, and which has only been known to science a dozen years, bears the burthen of no less than six names in botanical works. This is the *Bryomorpha rupifraga* of Karelin and Kireloff (enumeration of Soongarian plants), who first described it from specimens gathered in 1841, on the Alatau mountains (east of Lake Aral). In Ledebour's "Flora Rossica" (i. p. 780) it appears as *Arenaria* (sub-genus *Dicranella*) *rupifraga*, Fenzl, MS. In Decaisne and Cambessede's Plants of Jacquemont's "Voyage aux Indes Orientales," it is described as *Flourensia cæspitosa*, and in the plates of that work it appears as *Periandra cæspitosa*; and lastly, in Endichler's "Genera Plantarum," Fenzl proposes the long new generic name of *Thylacospermum* for it. I have carefully compared the Himalayan and Alatau plants, and find no difference between them, except that the flower of the Himalayan one has 4 petals and sepals, 8 stamens, and 2 styles, and that of the Alatau 5 petals and sepals, 10 stamens, and 2—3 styles, characters which are very variable in allied plants. The flowers appear polygamous, as in the Scotch alpine *Cherleria*, which it much resembles in habit, and to which it is very nearly related in botanical characters.

reached the Tibetans, from whom I obtained a guide in consequence. From this place a ride of about four miles brought me to the source of the Chachoo, in a deep ravine, containing the terminations of several short, abrupt glaciers,[1] and into which were precipitated avalanches of snow and ice. I found it impossible to distinguish the glacial ice from perpetual snow; the larger beds of snow where presenting a flat surface, being generally drifts collected in hollows, or accumulations that have fallen from above: when these accumulations rest on slopes they become converted into ice, and, obeying the laws of fluidity, flow downwards as glaciers. I boiled water at the most advantageous position I could select, and obtained an elevation of 16,522 feet.[2] It was snowing heavily at this time, and we crouched under a gigantic boulder, benumbed with cold. I had fortunately brought a small phial of brandy, which, with hot water from the boiling-apparatus kettle, refreshed us wonderfully.

The spur that divides these plains from the Lachen river, rises close to Kinchinjhow, as a lofty cliff of quartzy gneiss, dipping north-east 30°: this I had noticed from the Kongra Lama side. On this side the dip was also to the northward, and the whole cliff was crossed by cleavage planes, dipping south, and apparently cutting those of the foliation at an angle of about 60°: it is the only decided instance of the kind I met with in Sikkim. I regretted not being able to examine it carefully, but I was prevented by the avalanches of stones and snow which were continually being detached from its surface.[3]

[1] De Saussure's glaciers of the second order: see "Forbes' Travels in the Alps," p. 79.

[2] Temperature of boiling water, 183°, air 35°.

[3] I extremely regret not having been at this time acquainted with Mr. D. Sharpe's able essays on the foliation, cleavage, &c., of slaty rocks, gneiss, &c., in the Geological Society's Journal (ii. p. 74, and v. p. 111), and still more so with his subsequent papers in the Philosophical Transactions: as I cannot doubt that many of his observations, and in particular those which refer to the great arches in which the folia (commonly called strata) are disposed, would receive ample illustration from a study of the Himalaya. At vol. i. p. 309, I have distantly alluded to such an arrangement of the gneiss, &c., into arches, in Sikkim, to which my attention was naturally drawn by the writings of Professor Sedgwick ("Geolog. Soc. Trans.") and Mr. Darwin ("Geological Observations in South America") on these obscure subjects. I may add that wherever I met with the gneiss, mica, schists, and slates, in Sikkim, very near one another, I invariably found that their cleavage and foliation were conformable. This, for example, may be seen in the bed of the great Rungeet, below Darjeeling, where the slates overlie mica schists, and where the latter contain beds of conglomerate. In this volume I have often used the more familiar term of stratification, for foliation. This arises from my own ideas of the subject not having been clear when the notes were taken.

The plants found close to the snow were minute primroses, *Parnassia*, *Draba*, tufted wormwoods (*Artemisia*), saxifrages, gentians, small *Compositæ*, grasses, and sedges. Our ponies unconcernedly scraped away the snow with their hoofs, and nibbled the scanty herbage. When I mounted mine, he took the bit between his teeth, and scampered back to Palung, over rocks and hills, through bogs and streams; and though the snow was so blinding that no object could be distinguished, he brought me to the tents with unerring instinct, as straight as an arrow.

Wild animals are few in kind and rare in individuals, at Tungu and elsewhere on this frontier; though there is no lack of cover and herbage. This must be owing to the moist cold atmosphere; and it reminds me that a similar want of animal life is characteristic of those climates at the level of the sea, which I have adduced as bearing a great analogy to the Himalaya, in lacking certain natural orders of plants. Thus, New Zealand and Fuegia possess, the former no land animal but a rat, and the latter very few indeed, and none of any size. Such is also the case in Scotland and Norway. Again, on the damp west coast of Tasmania, quadrupeds are rare; whilst the dry eastern half of the island once swarmed with opossums and kangaroos. A few miles north of Tungu, the sterile and more lofty provinces of Tibet abound in wild horses, antelopes, hares, foxes, marmots, and numerous other quadrupeds; although their altitude, climate, and scanty vegetation are apparently even more unsuited to support such numbers of animals of so large a size than the karroos of South Africa, and the steppes of Siberia and Arctic America, which similarly abound in animal life. The laws which govern the distribution of large quadrupeds seem to be intimately connected with those of climate; and we should have regard to these considerations in our geological speculations, and not draw hasty conclusions from the absence of the remains of large herbivora in formations disclosing a redundant vegetation.

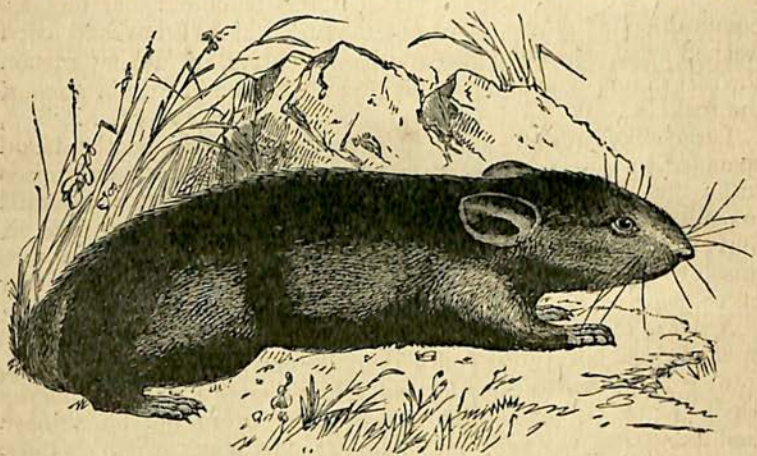
Besides the wild sheep found on these mountains, a species of marmot [1] ("Kardiepieu" of the Tibetans) sometimes migrates in swarms (like the Lapland "Lemming") from Tibet as far as Tungu. There are few birds but red-legged crows and common ravens. Most of the insects belonged to arctic types, and they were numerous in individuals.[2]

[1] The *Lagopus Tibetanus* of Hodgson. I procured one that displayed an extraordinary tenacity of life: part of the skull was shot away, and the brain protruded; still it showed the utmost terror at my dog.

[2] As *Melo* and some flower-feeding lamellicorns. Of butterflies I saw blues

The Choongtam Lama was at a small temple near Tungu during the whole of my stay, but he would not come to visit me, pretending to be absorbed in his devotions. Passing one day by the temple, I found him catechising two young aspirants for holy orders. He is one of the Dukpa sect, wore his mitre, and was seated cross-legged on the grass with his scriptures on his knees: he put questions to the boys, when he who answered best took the other some yards off, put him down on his hands and knees, threw a cloth over his back, and mounted; then kicking, spurring, and cuffing his steed, he was galloped back to the Lama and kicked off; when the catechising recommenced.

I spent a week at Tungu most pleasantly, ascending the neigh-



TIBET MARMOT.

bouring mountains, and mixing with the people, whom I found uniformly kind, frank, and extremely hospitable; sending their children after me to invite me to stop at their tents, smoke, and drink tea; often refusing any remuneration, and giving my attendants curds and yak-flesh. If on foot, I was entreated to take a pony; and when tired I never scrupled to catch one, twist a yak-hair rope over its jaw as a bridle, and throwing a goat-hair cloth upon its back (if no saddle were at hand), ride away whither I would. Next morning a boy would be sent for the steed, perhaps bringing an invitation to come and take it again. So I became

(*Polyommatus*), marbled whites, *Pontia*, *Colias* and *Argynnis*. A small *Curculio* was frequent, and I found *Scolopendra*, ants and earthworms, on sunny exposures as high as 15,500 feet.

fond of brick-tea boiled with butter, salt and soda, and expert in the Tartar saddle; riding about perched on the shoulders of a rough pony, with my feet nearly on a level with my pockets, and my knees almost meeting in front.

On the 28th of July much snow fell on the hills around, as low as 14,000 feet, and half an inch of rain at Tungu;[1] the former soon melted, and I made an excursion to Chomiomo on the following day, hoping to reach the lower line of perpetual snow. Ascending the valley of the Chomiochoo, I struck north up a steep slope, that ended in a spur of vast tabular masses of quartz and felspar, piled like slabs in a stone quarry, dipping south-west 5° to 10°, and striking north-west. These resulted from the decomposition of gneiss, from which the layers of mica had been washed away, when the rain and frost splitting up the fragments, the dislocation is continued to a great depth into the substance of the rock.

Large silky cushions of a forget-me-not grew amongst the rocks, spangled with beautiful blue flowers, and looking like turquoises set in silver: the *Delphinium glaciale*[2] was also abundant, exhaling a rank smell of musk. It indicates a very great elevation in Sikkim, and on my ascent far above it, therefore, I was not surprised to find water boil at 182° 6 (air 43°), which gives an altitude of 16,754 feet.

A dense fog, with sleet, shut out all view; and I did not know in what direction to proceed higher, beyond the top of the sharp stony ridge I had attained. Here there was no perpetual snow, which is to be accounted for by the nature of the surface facilitating its removal, the edges of the rocks which project through the snow, becoming heated, and draining off the water as it melts.

During my stay at Tungu, from the 23rd to the 30th of July, no day passed without much deposition of moisture, but generally in so light a form that throughout the whole time but one inch was registered in the rain-gauge; during the same time four inches and a half of rain fell at Darjeeling, and three inches and a half at Calcutta. The mean temperature was 50° ($\frac{\text{Max. } 65°}{\text{Min. } 40°\ 7}$); extremes, $\frac{65°}{38°}$. The mean range (23° 3) was thus much greater than at Darjeeling, where it was only 8° 9. A thermometer, sunk three

[1] An inch and a half fell at Darjeeling during the same period.

[2] This new species has been described for the "Flora Indica" of Dr. Thomson and myself: it is a remarkable plant, very closely resembling, and as it were representing, the *D. Brunonianum* of the Western Himalaya. The latter plant smells powerfully of musk, but not so disagreeably as this does.

feet, varied only a few tenths from 57° 6. By twenty-five comparative observations with Calcutta, 1° Fahr. is the equivalent of every 362 feet of ascent; and twenty comparative observations with Darjeeling give 1° for every 340 feet. The barometer rose and fell at the same hours as at lower elevations; the tide amounting to 0·060 inch, between 9·50 A.M. and 4 P.M.

I left Tungu on the 30th of July, and spent that night at Tallum, where a large party of men had just arrived, with loads of madder, rice, canes bamboos, planks, &c., to be conveyed to Tibet on yaks and ponies.[1] On the following day I descended to Lamteng, gathering a profusion of fine plants by the way.

The flat on which I had encamped at this place in May and June, being now a marsh, I took up my abode for two days in one of the houses, and paid the usual penalty of communication with these filthy people; for which my only effectual remedy was boiling all my garments and bedding. Yet the house was high, airy, and light; the walls composed of bamboo, lath, and plaster.

Tropical Cicadas ascend to the pine-woods above Lamteng in this month, and chirp shrilly in the heat of the day; and glow-worms fly about at night. The common Bengal and Java toad, *Bufo scabra*, abounded in the marshes, a remarkable instance of wide geographical distribution, for a Batrachian which is common at the level of the sea under the tropics.

On the 3rd of August I descended to Choongtam, which I reached on the 5th. The lakes on the Chateng flat (alt. 8,756 feet) were very full, and contained many English water-plants:[2] the temperature of the water was 92° near the edges, where a water-insect (*Notonecta*) was swimming about.

Below this I passed an extensive stalactitic deposit of lime, and a second occurred lower down, on the opposite side of the valley. The apparently total abstinence of limestone rocks in any part of Sikkim (for which I made careful search), renders these deposits, which are far from unfrequent, very curious. Can the limestone, which appears in Tibet, underlie the gneiss of Sikkim? We cannot venture to assume that these lime-charged streams, which in Sikkim burst from the steep flanks of narrow mountain spurs,

[1] About 300 loads of timber, each of six planks, are said to be taken across the Kongra Lama pass annually; and about 250 of rice, besides canes, madder, bamboos, cottons, cloths, and *Symplocos* leaves for dyeing. This is, no doubt, a considerably exaggerated statement, and may refer to both the Kongra Lama and Donkia passes.

[2] *Sparganium ramosum*, *Eleocharis palustris*, *Scirpus triqueter*, and *Callitriche verna?* Some very tropical genera ascend thus high; as *Paspalum* amongst grasses, and *Scleria*, a kind of sedge.

at elevations between 1,000 and 7,000 feet, have any very remote or deep origin. If the limestone be not below the gneiss, it must either occur intercalated with it, or be the remains of a formation now all but denuded in Sikkim.

Terrific landslips had taken place along the valley, carrying down acres of rock, soil, and pine-forests, into the stream. I saw one from Kampo Samdong, on the opposite flank of the valley, which swept over 100 yards in breadth of forest. I looked in vain for any signs of scratching or scoring, at all comparable to that produced by glacial action. The bridge at the Tuktoong, mentioned at p. 310, being carried away, we had to ascend for 1,000 feet (to a place where the river could be crossed) by a very precipitous path, and descend on the opposite side. In many places we had great difficulty in proceeding, the track being obliterated by the rains, torrents, and landslips. Along the flats, now covered with a dense rank vegetation, we waded ancle, and often knee, deep in mud, swarming with leeches; and instead of descending into the valley of the now too swollen Lachen, we made long detours, rounding spurs by canes and bamboos suspended from trees.

At Choongtam the rice-fields were flooded: and the whole flat was a marsh, covered with tropical grasses and weeds, and alive with insects, while the shrill cries of cicadas, frogs and birds, filled the air. Sand-flies, mosquitos, cockroaches, and enormous cockchafers,[1] *Mantis*, great locusts, grasshoppers, flying-bugs, crickets, ants, spiders, caterpillars, and leeches, were but a few of the pests that swarmed in my tent and made free with my bed. Great lazy butterflies floated through the air; *Thecla* and *Hesperides* skipped about, and the great *Nymphalidæ* darted around like swallows. The venomous black cobra was common, and we left the path with great caution, as it is a lazy reptile, and lies basking in the sun; many beautiful and harmless green snakes,

[1] *Eucerris Griffithii*, a magnificent species. Three very splendid insects of the outer ranges of Sikkim never occurred in the interior: these are a gigantic Curculio (*Calandra*), a wood-borer; a species of Goliath-beetle, *Cheirotonus Macleaii*, and a smaller species of the same rare family, *Trigonophorus nepalensis*; of these the former is very scarce, the latter extremely abundant, flying about at evenings; both are flower-feeders, eating honey and pollen. In the summer of 1848, the months at Darjeeling were well marked by the swarms of peculiar insects that appeared in inconceivable numbers; thus, April was marked by a great black *Passalus*, a beetle one-and-a-half inch long, that flies in the face and entangles itself in the hair; May, by stag-beetles and longicorns; June, by *Coccinella* (lady-birds), white moths, and flying-bugs; July, by a *Dryptis?* a long-necked and carabideous insect; August, by myriads of earwigs, cockroaches, Goliath-beetles, and cicadas; September, by spiders.

four feet long, glided amongst the bushes. My dogs caught a "Rageu,"[1] a very remarkable animal, half goat and half deer; the flesh was good and tender, dark-coloured, and lean.

I remained here till the 15th of August,[2] arranging my Lachen valley collections previous to starting for the Lachoong, whence I hoped to reach Tibet again by a different route, crossing the Donkia pass, and thence exploring the sources of the Teesta at the Cholamoo lakes.

Whilst here I ascertained the velocity of the currents of the Lachen and Lachoong rivers. Both were torrents, than which none could be more rapid, short of becoming cataracts: the rains were at their height, and the melting of the snows at its maximum. I first measured several hundred yards along the banks of each river above the bridges, repeating this several times, as the rocks and jungle rendered it very difficult to do it accurately: then, sitting on the bridge, I timed floating masses of different materials and sizes that were thrown in at the upper point. I was surprised to find the velocity of the Lachen only nine miles per hour, for its waters seemed to shoot past with the speed of an arrow, but the floats showed the whole stream to be so troubled with local eddies and backwaters, that it took from forty-three to forty-eight seconds for each float to pass over 200 yards, as it was perpetually submerged by under-currents. The breadth of the river averaged sixty-eight feet, and the discharge was 4,420 cubic feet of water per second. The temperature was 57°.

At the Lachoong bridge the jungle was still denser, and the banks quite inaccessible in many places. The mean velocity was eight miles an hour, the breadth ninety-five feet, the depth about the same as that of the Lachen, giving a discharge of 5,700 cubic feet of water per second;[3] its temperature was also 57°.

[1] "Ragoah," according to Hodgson: but it is not the *Procapra picticaudata* of Tibet.

[2] Though 5° further north, and 5,268 feet above the level of Calcutta, the mean temperature at Choongtam this month was only 12° 5 cooler than at Calcutta; forty observations giving 1° Fahr. as equal to 690 feet of elevation; whereas in May the mean of twenty-seven observations gave 1° Fahr. as equal to 260 feet, the mean difference of temperature being then 25°. The mean maximum of the day was 80°, and was attained at 11 A.M., after which clouds formed, and the thermometer fell to 66° at sunset, and 56° at night. In my blanket tent the heat rose to upwards of 100° in calm weather. The afternoons were generally squally and rainy.

[3] Hence it appears that the Lachoong, being so much the more copious stream, should in one sense be regarded as the continuation of the Teesta, rather than the Lachen, which, however, has by far the most distant source.

These streams retain an extraordinary velocity, for many miles upwards; the Lachen to its junction with the Zemu at 9,000 feet, and the Zemu itself as far up as the Thlonok, at 10,000 feet, and the Lachoong to the village of that name, at 8,000 feet: their united streams appear equally rapid till they become the Teesta at Singtam.[1]

On the 15th of August, having received supplies from Darjeeling, I started up the north bank of the Lachoong, following the Singtam Soubah, who accompanied me officially, and with a very bad grace; poor fellow, he expected me to have returned with him to Singtam, and thence gone back to Darjeeling, and many a sore struggle we had on this point. At Choongtam he had been laid up with ulcerated legs from the bites of leeches and sand-flies, which required my treatment.

The path was narrow, and ran through a jungle of mixed tropical and temperate plants,[2] many of which are not found at this elevation on the damp outer ranges of Darjeeling. We crossed to the south bank by a fine cane-bridge forty yards long, the river being twenty-eight across: and here I have to record the loss of my dog Kinchin; the companion of all my late journeyings, and to whom I had become really attached. He had a bad habit, of which I had vainly tried to cure him, of running for a few yards on the round bamboos by which the cane-bridges are crossed, and on which it was impossible for a dog to retain his footing: in this situation he used to get thoroughly frightened, and lie down on the bamboos with his legs hanging over the water, and having no hold whatever. I had several times rescued him from this perilous position, which was always rendered more imminent from the shaking of the bridge as I approached him. On the present occasion, I stopped at the foot of some rocks below the bridge, botanising, and Kinchin having scrambled up the rocks, ran on to the bridge. I could not see him, and was not thinking about him, when suddenly his shrill, short barks of terror rang above the roaring torrent. I

Their united streams discharge upwards of 10,000 cubic feet of water per second in the height of the rains! which is, however, a mere fraction of the discharge of the Teesta when that river leaves the Himalaya. The Ganges at Hurdwar discharges 8,000 feet per second during the dry season.

[1] The slope of the bed of the Lachen from below the confluence of the Zemu to the village of Singtam is 174 feet per mile, or 1 foot in 30; that of the Lachoong from the village of that name to Singtam is considerably less.

[2] As *Paris*, *Dipsacus*, *Circæa*, *Thalictrum*, *Saxifraga ciliaris*, *Spiranthes*, *Malva*, *Hypoxis*, *Anthericum*, *Passiflora*, *Drosera*, *Didymocarpus*, poplar, *Calamagrostis*, and *Eupatorium*.

hastened to the bridge, but before I could get to it, he had lost his footing, and had disappeared. Holding on by the canes, I strained my eyes till the bridge seemed to be swimming up the valley, and the swift waters to be standing still, but to no purpose; he had been carried under at once, and swept away miles below. For many days I missed him by my side on the mountain, and by my feet in camp. He had become a very handsome dog, with glossy black hair, pendent triangular ears, short muzzle, high forehead, jet-black eyes, straight limbs, arched neck, and a most glorious tail curling over his back.[1]

A very bad road led to the village of Keadom, situated on a flat terrace several hundred feet above the river, and 6,609 feet above the sea, where I spent the night. Here are cultivated plantains and maize, although the elevation is equal to parts of Darjeeling, where these plants do not ripen.

The river above Keadom is again crossed, by a plank bridge, at a place where the contracted streams flow between banks forty feet high, composed of obscurely stratified gravel, sand, and water-worn boulders. Above this the path ascends lofty flat-topped spurs, which overhang the river, and command some of the most beautiful scenery in Sikkim. The south-east slopes are clothed with *Abies Brunoniana* at 8,000 feet elevation, and cleft by a deep ravine, from which projects what appears to be an old moraine, fully 1,500, or perhaps 2,000 feet high. Extensive landslips on its steep flank expose (through the telescope) a mass of gravel and angular blocks, while streams cut deep channels in it.

This valley is more open and grassy than that of the Lachen, and the vegetation also differs much.[2] In the afternoon we reached Lachoong, which is by far the most picturesque village in the temperate region of Sikkim. Grassy flats of different levels, sprinkled with brushwood and scattered clumps of pine and maple, occupy the valley; whose west flanks rise in steep, rocky, and scantily wooded grassy slopes. About five

[1] The woodcut at p. 142, gives the character of the Tibet mastiff, to which breed his father belonged; but it is not a portrait of himself, having been sketched from a dog of the pure breed, in the Zoological Society's Gardens, by C. Jenyns, Esq.

[2] *Umbelliferæ* and *Compositæ* abound, and were then flowering: and an orchis (*Satyrium Nepalense*), scented like our English *Gymnadenia*, covered the ground in some places, with tall green *Habenariæ* and a yellow *Spathoglottis*, a genus with pseudo-bulbs. Of shrubs, *Xanthoxylon*, *Rhus*, *Prinsepia*, *Cotoneaster*, *Pyrus*, poplar and oak, formed thickets along the path; while there were as many as eight and nine kinds of balsams, some eight feet high.

miles to the north the valley forks; two conspicuous domes of snow rising from the intermediate mountains. The eastern valley leads to lofty snowed regions, and is said to be impracticable; the Lachoong flows down the western, which appeared rugged, and covered with pine woods. On the east, Tunkra mountain [1] rises in a superb unbroken sweep of dark pine-wood and cliffs, surmounted by black rocks and white fingering peaks

Larch.

LACHOONG VALLEY AND VILLAGE, LOOKING SOUTH.

of snow. South of this, the valley of the Tunkrachoo opens, backed by sharp snowed pinnacles, which form the continuation of the Chola range; over which a pass leads to the Phari district of Tibet, which intervenes between Sikkim and Bhotan. Southwards the view is bounded by snowy mountains, and the valley seems blocked up by the remarkable moraine-like spur which I passed above Keadom.

[1] This mountain is seen from Darjeeling; its elevation is about 18,700 feet.

Stupendous moraines rise 1,500 feet above the Lachoong in several concentric series, curving downwards and outwards, so as to form a bell-shaped mouth to the valley of the Tunkrachoo. Those on the upper flank are much the largest; and the loftiest of them terminates in a conical hill crowned with Boodhist flags, and its steep sides cut into horizontal roads or terraces, one of which is so broad and flat as to suggest the idea of its having been cleared by art. On the south side of the Tunkrachoo river

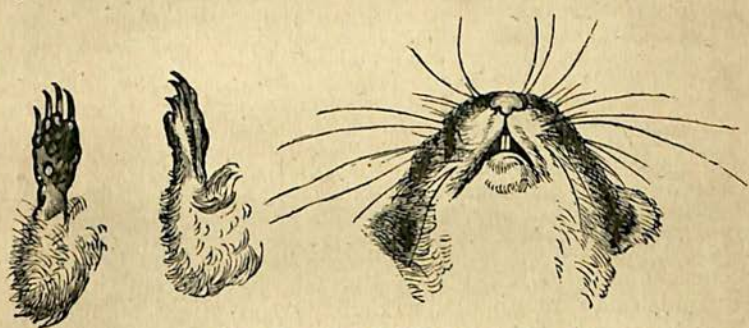
Abies Smithiana. *Larch.* *Abies Brunoniana.*

LOFTY ANCIENT MORAINES, IN THE LACHOONG VALLEY, LOOKING SOUTH-EAST.

the moraines are also more or less terraced, as is the floor of the Lachoong valley, and its east slopes, 1,000 feet up.[1]

[1] I have since been greatly struck with the similarity between the features of this valley, and those of Chamouni (though the latter is on a smaller scale) above the Lavanchi moraine. The spectator standing in the expanded part below the village of Argentière, and looking upwards, sees the valley closed

The river is fourteen yards broad, and neither deep nor rapid: the village is on the east bank, and is large for Sikkim; it contains fully 100 good wooden houses, raised on posts, and clustered together without order. It was muddy and intolerably filthy, and intersected by some small streams, whose beds formed the roads, and, at the same time, the common sewers of the natives. There is some wretched cultivation in fields,[1] of wheat, barley, peas, radishes, and turnips. Rice was once cultivated at this elevation (8,000 feet), but the crop was uncertain; some very tropical grasses grow wild here, as *Eragrostis* and *Panicum*. In gardens the hollyhock is seen: it is said to be introduced through Tibet from China; also *Pinus excelsa* from Bhotan, peaches, walnuts, and weeping willows. A tall poplar was pointed out to me as a great wonder; it had two species of *Pyrus* growing on its boughs, evidently from seed; one was a mountain ash, the other like *Pyrus Aria*.



HEAD AND FEET OF TIBET MARMOT.

Soon after camping, the Lachoong Phipun, a very tall, intelligent, and agreeable looking man, waited on me with the usual presents, and a request that I would visit his sick father. His house was lofty and airy: in the inner room the sick man was stretched on a board, covered with a blanket, and dying of

above by the ancient moraine of the Argentière glacier, and below by that of Lavanchi; and on all sides the slopes are cut into terraces, strewed with boulders. I found traces of stratified pebbles and sand on the north flank of the Lavanchi moraine however, which I failed to discover in those of Lachoong. The average slope of these pine-clad Sikkim valleys much approximates to that of Chamouni, and never approaches the precipitous character of the Bernese Alps' valleys, Kandersteg, Lauterbrunnen, and Grindelwald.

[1] Full of such English weeds as shepherd's purse, nettles, *Solanum nigrum*, and dock; besides many Himalayan ones, as balsams, thistles, a beautiful geranium, mallow, *Haloragis* and Cucurbitaceous plants.

pressure on the brain; he was surrounded by a deputation of Lamas from Teshoo Loombo, sent for in this emergency. The principal one was a fat fellow, who sat cross-legged before a block-printed Tibetan book, plates of raw meat, rice, and other offerings, and the bells, dorje, &c. of his profession. Others sat around, reading or chanting services, and filling the room with incense. At one end of the apartment was a good library in a beautifully carved book-case.

CHAPTER XXII.

Leave Lachoong for Tunkra pass—Moraines and their vegetation—Pines of great dimensions—Wild currants—Glaciers—Summit of pass—Elevation—Views—Plants—Winds—Choombi district—Lacheepia rock—Extreme cold—Kinchinjunga—Himalayan grouse—Meteorological observations—Return to Lachoong—Oaks—Ascent to Yeumtong—Flats and debâcles—Buried pine-trunks—Perpetual snow—Hot springs—Behaviour of Singtam Soubah—Leave for Momay Samdong—Upper limit of trees—Distribution of plants—Glacial terraces, &c.—Forked Donkia—Moutonnéed rocks—Ascent to Donkia pass—Vegetation—Scenery—Lakes—Tibet—Bhomtso—Arun river—Kiang-lah mountains—Yara-Tsampu river—Appearance of Tibet—Kambajong—Jigatzi—Kinchinjhow, and Kinchinjunga—Chola range—Deceptive appearance of distant landscape—Perpetual snow—Granite—Temperatures—Pulses—Plants—Tripe de roche—Return to Momay—Dogs and yaks—Birds—Insects—Quadrupeds—Hot springs—Marmots—Kinchinjhow glacier.

THE Singtam Soubah being again laid up here from the consequences of leech-bites, I took the opportunity of visiting the Tunkra-lah pass, represented as the most snowy in Sikkim; which I found to be the case. The route lay over the moraines on the north flank of the Tunkrachoo, which are divided by narrow dry gullies,[1] and composed of enormous blocks disintegrating into a deep layer of clay. All are clothed with luxuriant herbage and flowering shrubs,[2] besides small larches and pines, rhododendrons and maples; with *Enkianthus*, *Pyrus*, cherry, *Pieris*, laurel, and

[1] These ridges of the moraine, separated by gullies, indicate the progressive retirement of the ancient glacier, after periods of rest. The same phenomena may be seen, on a diminutive scale, in the Swiss Alps, by any one who carefully examines the lateral and often the terminal moraines of any retiring or diminishing glacier, at whose base or flanks are concentric ridges, which are successive deposits.

[2] *Ranunculus*, *Clematis*, *Thalictrum*, *Anemone*, *Aconitum variegatum* of Europe, a scandent species, Berberry, *Deutzia*, *Philadelphus*, Rose, Honeysuckle, Thistles, Orchis, *Habenaria*, *Fritillaria*, *Aster*, *Calimeris*, *Verbascum thapsus*, *Pedicularis*, *Euphrasia*, *Senecio*, *Eupatorium*, *Dipsacus*, *Euphorbia*, Balsam, *Hypericum*, *Gentiana*, *Halenia*, *Codonopsis*, *Polygonum*.

Goughia. The musk-deer inhabits these woods, and at this season I have never seen it higher. Large monkeys are also found on the skirts of the pine-forests, and the *Ailurus ochraceus* (Hodgs.), a curious long-tailed animal peculiar to the Himalaya, something between a diminutive bear and a squirrel. In the dense and gigantic forest of *Abies Brunoniana* and silver fir, I measured one of the former trees, and found it twenty-eight feet in girth, and above 120 feet in height. The *Abies Webbiana* attains thirty-five feet in girth, with a trunk unbranched for forty feet.

The path was narrow and difficult in the wood, and especially along the bed of the stream, where grew ugly trees of larch, eighty feet high, and abundance of a new species of alpine strawberry with oblong fruit. At 11,560 feet elevation, I arrived at an immense rock of gneiss, buried in the forest. Here currant-bushes were plentiful, generally growing on the pine-trunks, in strange association with a small species of *Begonia*, a hothouse tribe of plants in England. Emerging from the forest, vast old moraines are crossed, in a shallow mountain valley, several miles long and broad, 12,000 feet above the sea, choked with rhododendron shrubs, and nearly encircled by snowy mountains. Magnificent gentians grew here, also *Senecio*, *Corydalis*, and the *Aconitum luridum* (n. sp.), whose root is said to be as virulent as *A. ferox* and *A. Napellus*.[1] The plants were all fully a month behind those of the Lachen valley at the same elevation. Heavy rain fell in the afternoon, and we halted under some rocks: as I had brought no tent, my bed was placed beneath the shelter of one, near which the rest of the party burrowed. I supped off half a yak's kidney, an enormous organ in this animal.

On the following morning we proceeded up the valley, towards a very steep rocky barrier, through which the river cut a narrow gorge, and beyond which rose lofty snowy mountains: the peak of Tunkra being to our left hand (north). Saxifrages grew here in profuse tufts of golden blossoms, and *Chrysosplenium*, rushes, mountain-sorrel (*Oxyria*), and the bladder-headed *Saussurea*, whose flowers are enclosed in inflated membranous bracts, and smell like putrid meat: there were also splendid primroses, the spikenard valerian, and golden Potentillas.

The ascent was steep and difficult, up a stony valley bounded

[1] The result of Dr. Thomson's and my examination of the Himalayan aconites (of which there are seven species) is that the one generally known as *A. ferox*, and which supplies a great deal of the celebrated poison, is the common *A. Napellus* of Europe.

by precipices; in this the river flowed in a north-west direction, and we were obliged to wade along it, though its waters were bitterly cold, the temperature being 39°. At 15,000 feet we passed from great snow-beds to the surface of a glacier, partly an accumulation of snow, increased by lateral glaciers: its slope was very gentle for several miles; the surface was eroded by rain, and very rough, whilst those of the lateral glaciers were ribboned, crevassed, and often conspicuously marked with dirt-bands.

A gentle sloping saddle, bare of snow, which succeeds the glacier, forms the top of the Tunkra pass; it unites two snowy mountains, and opens on the great valley of the Machoo, which flows in a part of Tibet between Sikkim and Bhotan; its height is 16,083 feet above the sea by barometer, and 16,137 feet by boiling-point. Nothing can be more different than the two slopes of this pass; that by which I had come presented a gentle snow acclivity, bounded by precipitous mountains; while that which opened before me was a steep, rocky, broad, grassy valley, where not a particle of snow was to be seen, and yaks were feeding near a small lake not 1,000 feet down. Nor were snowy mountains visible anywhere in this direction, except far to the south-east, in Bhotan. This remarkable difference of climate is due to the southerly wind which ascends the Tibetan or Machoo valley being drained by intervening mountains before reaching this pass, whilst the Sikkim current brings abundant vapours up the Teesta and Lachoong valleys.

Chumulari lies to the E.N.E of the Tunkra pass, and is only twenty-six miles distant, but not seen; Phari is two marches off, in an easterly direction, and Choombi one to the south-east. Choombi is the general name given to a large Tibetan province that embraces the head of the Machoo river, and includes Phari, Eusa, Choombi, and about thirteen other villages, corresponding to as many districts, that contain from under a dozen to 300 houses each, varying with the season and state of trade. The latter is considerable, Phari being, next to Darjeeling, the greatest Tibetan, Bhotan, Sikkim, and Indian entrepôt along the whole Himalaya east of Nepal. The general form of Choombi valley is triangular, the broader end northwards: it is bounded by the Chola range on the west from Donkia to Gipmoochi, and by the Kamphee or Chakoong range to the east; which is, I believe, continuous with Chumulari. These meridonial ranges approximate to the southward, so as to form a natural boundary to Choombi. The Machoo river, rising from Chumulari, flows through the Choombi district, and enters Bhotan at a large mart

called Rinchingoong, whence it flows to the plains of India, where it is called at Cooch-Behar, the Torsha, or, as some say, the Godadda, and falls into the Burrampooter.

The Choombi district is elevated, for the only cultivation is a summer or alpine one, neither rice, maize, nor millet being grown there: it is also dry, for the great height of the Bhotan mountains and the form of the Machoo valley cut off the rains, and there is no dense forest. It is very mountainous, all carriage being on men's and yaks' backs, and is populous for this part of the country, the inhabitants being estimated at 3,000 in the trading season, when many families from Tibet and Bhotan erect booths at Phari.

A civil officer at Phari collects the revenue under the Lhassan authorities, and there is also a Tibetan fort, an officer, and guard. The inhabitants of this district more resemble the Bhotanese than Tibetans, and are a thievish set, finding a refuge under the Paro-Pilo of Bhotan,[1] who taxes the refugees according to the estimate he forms of their plunder. The Tibetans seldom pursue the culprits, as the Lhassan government avoids all interference south of their own frontier.

From Choombi to Lhassa is fifteen days' long journey for a man mounted on a stout mule; all the rice passing through Phari is monopolised there for the Chinese troops at Lhassa. The grazing for yaks and small cattle is excellent in Choombi, and the *Pinus excelsa* is said to grow abundantly there, though unknown in Sikkim, but I have not heard of any other peculiarity in its productions.

Very few plants grew amongst the stones at the top of the Tunkra pass, and those few were mostly quite different from those of Palung and Kongra Lama. A pink-flowered *Arenaria*, two kinds of *Corydalis*, the cottony *Saussurea*, and diminutive primroses, were the most conspicuous.[2] The wind was variable,

[1] There was once a large monastery, called Kazioo Goompa, at Choombi, with upwards of one hundred Lamas. During a struggle between the Sikkim and Bhotan monks for superiority in it, the abbot died. His avatar reappeared in two places at once! in Bhotan as a relative of the Paro-Pilo himself, and in Sikkim as a brother of the powerful Gangtok Kajee. Their disputes were referred to the Dalai Lama, who pronounced for Sikkim. This was not to be disputed by the Pilo, who, however, plundered the Goompa of its silver, gold, and books, leaving nothing but the bare walls for the successful Lama! The Lhassan authorities made no attempt to obtain restitution, and the monastery has been consequently neglected.

[2] The only others were *Leontopodium* [Edelweiss], *Sedum*, Saxifrage, *Ranunculus hyperboreus*, *Ligularia*, two species of *Polygonum*, a *Trichostomum*, *Stereocaulon*, and *Lecidea geographica*, not one grass or sedge.

blowing alternately up both valleys, bringing much snow when it blew from the Teesta, though deflected to a north-west breeze; when, on the contrary, it blew from Tibet, it was, though southerly, dry. Clouds obscured all distant view. The temperature varied between noon and 1.30 P.M. from 39° to 40° 5, the air being extremely damp.

Returning to the foot of the glacier, I took up my quarters for two days under an enormous rock overlooking the broad flat valley in which I had spent the previous night, and directly fronting Tunkra mountain, which bore north about five miles distant. This rock was sixty to eighty feet high, and 15,250 feet above the sea; it was of gneiss, and was placed on the top of a bleak ridge, facing the north; no shrub or bush being near it. The gentle slope outwards of the rock afforded the only shelter, and a more utterly desolate place than Lacheepia, as it is called, I never laid my unhoused head in. It commanded an incomparable view due west across the Lachoong and Lachen valleys, of the whole group of Kinchinjunga snows, from Tibet southwards, and as such was a most valuable position for geographical purposes.

The night was misty, and though the temperature was 35°, I was miserably cold; for my blankets being laid on the bare ground, the chill seemed to strike from the rock to the very marrow of my bones. In the morning the fog hung till sunrise, when it rose majestically from all the mountain-tops; but the view obtained was transient, for in less than an hour the dense woolly banks of fog which choked the valleys ascended like a curtain to the warmed atmosphere above, and slowly threw a veil over the landscape. I waited till the last streak of snow was shut out from my view, when I descended, to breakfast on Himalayan grouse (*Tetraoperdix nivicola*), a small gregarious bird which inhabits the loftiest stony mountains, and utters a short cry of "Quiok, quiok;" in character and appearance it is between grouse and partridge, and is good eating, though tough.

Hoping to obtain another view, which might enable me to correct the bearings taken that morning, I was tempted to spend a second night in the open air at Lacheepia, passing the day botanising[1] in the vicinity, and taking observations of the barometer and wet-bulb: I also boiled three thermometers by turns, noting

[1] Scarcely a grass, and no *Astragali*, grow on these stony and snowy slopes: and the smallest heath-like *Andromeda*, a still smaller *Menziesia* (an arctic genus, previously unknown in the Himalaya) and a prostrate willow, are the only woody-stemmed plants above 15,000 feet. [The supposed *Menzieria*, proved to be a new genus. *Diplarche*, peculiar to Sikkim.]

the grave errors likely to attend observations of this instrument for elevation. Little rain fell during the day, but it was heavy at night, though there was fortunately no wind; and I made a more comfortable bed with tufts of juniper brought up from below. Our fire was principally of wet rhododendron wood, with masses of the aromatic dwarf species, which, being full of resinous glands, blazed with fury.

Next day, after a very transient glimpse of the Kinchinjunga snows, I descended to Lachoong, where I remained for some days botanising. During my stay I was several times awakened by all the noises and accompaniments of a night-attack, or alarm; screaming voices, groans, shouts, and ejaculations, the beating of drums and firing of guns, and flambeaux of pine-wood gleaming amongst the trees, and flitting from house to house. The cause, I was informed, was the presence of a demon, who required exorcisement, and who generally managed to make the villagers remember his visit, by their missing various articles after the turmoil made to drive him away. The custom of driving out demons in the above manner is constantly practised by the Lamas in Tibet: MM. Huc and Gabet give a graphic account of such an operation during their stay in Kounboum.

On the 29th of August I left Lachoong and proceeded up the valley. The road ran along a terrace, covered with long grass, and bounded by lofty banks of unstratified gravel and sand, and passed through beautiful groves of green pines, rich in plants. No oak or chestnut ascends above 9,000 feet here or elsewhere in the interior of Sikkim, where they are replaced by a species of hazel (*Corylus*); in the North Himalaya, on the other hand, an oak (*Quercus semecarpifolia*, see p. 130) is amongst the most alpine trees, and the nut is a different species, more resembling the European. On the outer Sikkim ranges oaks (*Q. annulata?*) ascend to 10,000 feet, and there is no hazel. Above the fork, the valley contracts extremely, and its bed is covered with moraines and landslips, which often bury the larches and pines. Marshes occur here and there, full of the sweet-scented Hierochloe grass, the Scotch *Thalictrum alpinum*, and an *Eriocaulon*, which ascends to 10,000 feet. The old moraines were very difficult to cross, and on one I found a barricade, which had been erected to deceive me regarding the frontier, had I chosen this route instead of the Lachen one, in May.

Broad flats clothed with rhododendron, alternate with others covered with mud, boulders, and gravel, which had flowed down

from the gorges on the west, and which still contained trees, inclined in all directions, and buried up to their branches; some of these débâcles were 400 yards across, and sloped at an angle of 2° to 3°, bearing on their surface blocks fifteen yards in diameter.[1] They seem to subside materially, as I perceived they had left marks many feet higher on the tree-trunks. Such débâcles must often bury standing forests in a very favourable material, climate, and position for becoming fossilised.

On the 30th of August I arrived at Yeumtong, a small summer cattle-station, on a flat by the Lachoong, 11,920 feet above the sea; the general features of which closely resemble those of the narrow Swiss valleys. The west flank is lofty and precipitous, with narrow gullies still retaining the winter's snow, at 12,500 feet; the east gradually slopes up to the two snowy domes seen from Lachoong; the bed of the valley is alternately a flat lake-bed, in which the river meanders at the rate of three and a half miles an hour, and sudden descents, cumbered with old moraines, over which it rushes in sheets of foam. Silver-firs ascend nearly to 13,000 feet, where they are replaced by large junipers, sixty feet high: up the valley Chango Khang is seen, with a superb glacier descending to about 14,000 feet on its south flank. Enormous masses of rock were continually precipitated from the west side, close to the shed in which I had taken up my quarters, keeping my people in constant alarm, and causing a great commotion among the yaks, dogs, and ponies. On the opposite side of the river is a deep gorge; in which an immense glacier descends lower than any I have seen in Sikkim. I made several attempts to reach it by the gully of its discharging stream, but was always foiled by the rocks and dense jungle of pines, rhododendron, and dwarf holly.

The snow-banks on the face of the dome-shaped mountain appearing favourable for ascertaining the position of the level of perpetual snow, I ascended to them on the 6th of September, and found the mean elevation along an even, continuous, and gradual slope, with a full south-west exposure, to be 15,985 feet by barometer, and 15,816 feet by boiling-point. These beds of snow, however broad and convex, cannot nevertheless be distinguished from glaciers: they occupy, it is true, mountain slopes, and do not fill hollows (like glaciers commonly so called), but they display the ribboned structure of ice, and like viscous fluids, descend at a rate and to a distance depending on the slope, and on the

[1] None were to be compared in size and extent with that at Bex, at the mouth of the Rhone valley.

amount of annual accumulation behind. Their termination must therefore be far below that point at which all the snow that falls melts, which is the theoretical line of perpetual snow. Before returning I attempted to proceed northwards to the great glacier, hoping to descend by its lateral moraine, but a heavy snow-storm drove me down to Yeumtong.

Some hot-springs burst from the bank of the Lachen a mile or so below the village; they are used as baths, the patient remaining three days at a time in them, only retiring to eat in a little shed close by. The discharge amounts to a few gallons per minute; the temperature at the source is 112°6, and 106° in the bath.[1] The water has a slight saline taste; it is colourless, but emits bubbles of sulphuretted hydrogen gas, blackening silver. A cold spring (temperature 42°) emerged close by, and the Lachoong not ten yards off, was 47° to 50°. A conferva grows in the hot water, and the garnets are worn out of the gneiss rock exposed to its action.

The Singtam Soubah had been very sulky since leaving Choongtam, and I could scarcely get a drop of milk or a slice of curd here. I had to take him to task severely for sanctioning the flogging of one of my men; a huntsman, who had offered me his services at Choongtam, and who was a civil, industrious fellow, though he had procured me little besides a huge monkey, which had nearly bitten off the head of his best dog. I had made a point of consulting the Soubah before hiring him, for fear of accidents; but this did not screen him from the jealousy of the Choongtam Lama, who twice flogged him in the Goompa with rattans (with the Soubah's consent), alleging that he had quitted his service for mine. My people knew of this, but were afraid to tell me, which the poor fellow did himself.

The Lachoong Phipun visited me on the 7th of September: he had officiously been in Tibet to hear what the Tibetan people would say to my going to Donkia, and finding them supremely indifferent, returned to be my guide. A month's provision for ten men having arrived from Darjeeling, I left Yeumtong the following day for Momay Samdong, the loftiest yak grazing station in Sikkim (Palung being too cold for yaks), and within a day's journey of the Donkia pass.

The valley remains almost level for several miles, the roads continuing along the east bank of the Lachen. Shoots of stones

[1] This water boiled at 191° 6, the same at which snow-water and that of the river did; giving an elevation of 11,730 feet.

descend from the ravines, all of a white fine-grained granite, stained red with a minute conferva, which has been taken by Himalayan travellers for red snow;[1] a phenomenon I never saw in Sikkim.

At a fork of the valley several miles above Yeumtong, and below the great glacier of Chango Khang, the ancient moraines are prodigious, much exceeding any I have elsewhere seen, both in extent, in the size of the boulders, and in the height to which the latter are piled on one another. Many boulders I measured were twenty yards across, and some even forty; and the chaotic scene they presented baffles all description: they were scantily clothed with stunted silver firs.

Beyond this, the path crosses the river, and ascends rapidly over a mile of steeply sloping landslip, composed of angular fragments of granite, that are constantly falling from above, and are extremely dangerous. At 14,000 feet, trees and shrubs cease, willow and honeysuckle being the last; and thence onward the valley is bleak, open, and stony, with lofty rocky mountains on either side. The south wind brought a cold drizzling rain, which numbed us, and two of the lads who had last come up from Darjeeling were seized with a remittent fever, originally contracted in the hot valleys; luckily we found some cattle-sheds, in which I left them, with two men to attend on them.

Momay Samdong is situated in a broad part of the Lachoong valley, where three streams meet; it is on the west of Chango Khang, and is six miles south-east of Kinchinjhow, and seven south-west of Donkia: it is in the same latitude as Palung, but scarcely so lofty. The mean of fifty-six barometrical observations contemporaneous with Calcutta makes it 15,362 feet above the sea; nearly the elevation of Lacheepia (near the Tunkra pass), from which, however, its scenery and vegetation entirely differ.

I pitched my tent close to a little shed, at the gently sloping base of a mountain that divided the Lachoong river from a western tributary. It was a wild and most exposed spot: long stony mountains, grassy on the base near the river; distant snowy peaks, stupendous precipices, moraines, glaciers, transported boulders, and rocks rounded by glacial action, formed the dismal landscape which everywhere met the view. There was not a bush six inches high, and the only approach to woody plants

[1] Red snow was never found in the Antarctic regions during Sir James Ross's South Polar voyage; nor do I know any authentic record of its having been seen in the Himalaya.

were minute creeping willows and dwarf rhododendrons, with a very few prostrate junipers and *Ephedra*

The base of the spur was cut into broad flat terraces, composed of unstratified sand, pebbles, and boulders; the remains, doubtless, of an enormously thick glacial deposit. The terracing is as difficult to be accounted for in this valley as in that of Yangma (East Nepal); both valleys being far too broad, and descending too rapidly, to admit of the hypothesis of their having been blocked up in the lower part, and the upper filled with large lakes.[1] Another tributary falls into the Lachoong at Momay, which leads eastwards up to an enormous glacier that descends from Donkia. Snowy mountains rise nearly all round it: those on its south and east divide Sikkim from the Phari province in Tibet; those on the north terminate in a forked or cleft peak, which is a remarkable and conspicuous feature from Momay. This, which I have called forked Donkia,[2] is the termination of a magnificent amphitheatre of stupendous snow-clad precipices, continuously upwards of 20,000 feet high, that forms the east flank of the upper Lachoong. From Donkia top again, the mountains sweep round to the westward, rising into fingered peaks of extraordinary magnificence; and thence—still running west—dip to 18,500 feet, forming the Donkia pass, and rise again as the great mural mass of Kinchinjhow. This girdle of mountains encloses the head waters of the Lachoong, which rises in countless streams from its perpetual snows, glaciers, and small lakes: its north drainage is to the Cholamoo lakes in Tibet; in which is the source of the Lachen, which flows round the north base of Kinchinjhow to Kongra Lama.

The bottom of the Lachoong valley at Momay is broad, tolerably level, grassy, and covered with isolated mounds and ridges that point down the valley, and are the remains of glacial deposits. It dips suddenly below this, and some gneiss rocks that rise in its centre are remarkably *moutonnéed* or rounded.

[1] The formation of small lakes, however, between moraines and the sides of the valleys they occupy, or between two successively formed moraines (as I have elsewhere mentioned), will account for very extensive terraced areas of this kind; and it must be borne in mind that when the Momay valley was filled with ice, the breadth of its glacier at this point must have been twelve miles, and it must have extended east and west from Chango Khang across the main valley, to beyond Donkia. Still the great moraines are wanting at this particular point, and though atmospheric action and the rivers have removed perhaps 200 feet of glacial shingle, they can hardly have destroyed a moraine of rocks, large enough to block up the valley.

[2] Its elevation by my observation is about 21,870 feet.

Though manifestly rounded and grooved by ancient glaciers, I failed to find scratches on these weather-worn rocks.[1]

The Lachoong is here twelve or fifteen yards wide, and runs over a pebbly bed, cutting a shallow channel through the deposits, down to the subjacent rock, which is in some cases scooped out six or eight feet deep by its waters. I do not doubt that the flatness of the floor of the Momay valley is caused by the combined action of the streams that drained the three glaciers which met here; for the tendency of retiring glaciers is to level the floors of valleys, by giving an ever-shifting direction to the rivers which drain them, and which spread detritus in their course. Supposing these glaciers to have had no terminal moraines, they might still have forced immense beds of gravel into positions that would dam up lakes between the ice and the flanks of the valleys, and thus produce much terracing on the latter.[2]

On our arrival, we found that a party of buxom, good-natured looking girls who were tending yaks, were occupying the hut, which, however, they cheerfully gave up to my people, spreading a black tent close by for themselves; and next morning they set off with all their effects packed upon the yaks. The ground was marshy, and covered with cowslips, *Ranunculus*, grasses and

[1] I have repeatedly, and equally in vain, sought for scratchings on many of the most conspicuously mountonnéed gneiss rocks of Switzerland. The retention of such markings depends on other circumstances that the mere hardness of the rock, or amount of aqueous action. What can be more astonishing than to see these most delicate scratches retained in all their sharpness on rocks clothed with seaweed and shells, and exposed at every tide, in the bays of Western Scotland!

[2] We are still very ignorant of many details of ice action, and especially of the origin of many enormous deposits which are not true moraines. These, so conspicuous in the lofty Himalayan valleys, are not less so in those of the Swiss Alps: witness that broad valley in which Grindelwald village is situated, and which is covered to an immense depth with an angular detritus, moulded into hills and valleys; also the whole broad open Upper Rhone valley, above the village of Munster, and below that of Obergestelen. The action of broad glaciers on gentle slopes is to raise their own beds by the accumulation of gravel which their lower surface carries and pushes forward. I have seen small glaciers thus raised 300 feet; leaving little doubt in my mind that the upper Himalayan valleys were thus choked with deposit 1,000 feet thick, of which indeed the proofs remain along the flanks of the Yangma valley. The denuding and accumulating effects of ice thus give a contour to mountain valleys, and sculpture their flanks and floors far more rapidly than sea action, or the elements. After a very extensive experience of ice in the Antarctic ocean, and in mountainous countries, I cannot but conclude that very few of our geologists appreciate the power of ice as a mechanical agent, which can hardly be overestimated, whether as glacier, iceberg, or pack ice, heaping shingle along coasts,

sedges, *Cyananthus*, blue asters, gentians, &c. The spot appearing highly favourable for observations, I determined to remain here during the equinoctial month, and put my people on "two-thirds allowance," *i.e.*, four pounds of rice daily for three men, allowing them to send down the valley to cater for what more they could get. The Singtam Soubah was intensely disgusted with my determination: he accompanied me next day to the pass, and having exhausted his persuasions, threats, and warnings about snow, wind, robbers, starvation, and Cheen sepoys, departed on the 12th for Yeumtong, leaving me truly happy for the first time since quitting Darjeeling. I had now a prospect of uninterruptedly following up my pursuits at an elevation little below that of the summit of Mont Blanc, surrounded by the loftiest mountains, and perhaps the vastest glaciers on the globe; my instruments were in perfect order, and I saw around me a curious and varied flora.

The morning of the 9th of September promised fair, though billowy clouds were rapidly ascending the valley. To the eastward my attention was directed to a double rainbow; the upper was an arch of the usual form, and the lower was the curved illuminated edge of a bank of cumulus, with the orange hues below. I took the path to the Donkia pass, fording the river, and ascending in a north-east direction, along the foot of stony hills that rise at a gradual slope of 12° to broad unsnowed ridges, 18,000 to 19,000 feet high. Shallow valleys, glacier-bound at their upper extremities, descend from the still loftier rearward mountains; and in these occur lakes. About five miles up, a broad opening on the west leads to Tomo Chamo, as the eastern summit of Kinchinjhow is called.[1] Above this the valley expands very much, and is stony and desert: stupendous mountains, upwards of 21,000 feet high, rear themselves on all sides, and the desolation and grandeur of the scene are unequalled in my expe-

[1] On one occasion I ascended this valley, which is very broad, flat, and full of lakes at different elevations: one, at about 17,000 feet elevation, is three-quarters of a mile long, but not deep: no water-plants grew in it, but there were plenty of others round its margin. I collected, in the dry bed of a stream near it, a curious white substance like thick felt, formed of felspathic silt (no doubt the product of glacial streams) and the siliceous cells of infusoriæ. It much resembles the fossil or meteoric paper of Germany, which is also formed of the lowest tribes of fresh-water plants, though considered by Ehrenberg as of animal origin. A vein of granite in the bottom of the valley had completely altered the character of the gneiss, which contained veins of jasper and masses of amorphous garnet. Much olivine is found in the fissures of the gneiss: this mineral is very rare in Sikkim, but I have also seen it in the fissures of the white gneissy granite of the surrounding heights.

rience. The path again crosses the river (which is split into many channels), and proceeds northwards, over gravelly terraces and rocks with patches of Scotch alpine grasses (*Festuca ovina* and *Poa laxa*), sedges, *Stipa*, dandelion, *Allardia*, gentians, *Saussurea*, and *Astragalus*, varied with hard hemispherical mounds of the *Arenaria* mentioned at p. 351.

I passed several shallow lakes at 17,500 feet; their banks were green and marshy, and supported thirty or forty kinds of plants. At the head of the valley a steep rocky crest, 500 feet high, rises between two precipitous snowy peaks, and a very fatiguing ascent (at this elevation) leads to the sharp rocky summit of the Donkia pass, 18,466 feet above the sea by barometer, and 17,866 by boiling-point. The view on this occasion was obscured by clouds and fogs, except towards Tibet, in which direction it was magnificent; but as I afterwards ascended this pass, and also crossed it, I shall here bring together all the particulars I noted.

The Tibetan view, from its novelty, extent, and singularity, demands the first notice: the Cholamoo lake lay 1,500 feet below me, at the bottom of a rapid and rocky descent; it was a blue sheet of water, three or four miles from north to south, and one and a half broad, hemmed in by rounded spurs from Kinchinjhow on one side, and from Donkia on the other: the Lachen flowed from its northern extremity, and turning westward, entered a broad barren valley, bounded on the north by red stony mountains, called Bhomtso, which I saw from Kongra Lama, and ascended with Dr. Campbell in the October following: though 18,000 to 19,000 feet high, these mountains were wholly unsnowed. Beyond this range lay the broad valley of the Arun, and in the extreme north-west distance, to the north of Nepal, were some immense snowy mountains, reduced to mere specks on the horizon. The valley of the Arun was bounded on the north by very precipitous black rocky mountains, sprinkled with snow; beyond these again, from north to north-west, snow-topped range rose over range in the clear purple distance. The nearer of these was the Kiang-lah, which forms the axis or water-shed of this meridian; its south drainage being to the Arun river, and its north to the Yara-tsampu: it appeared forty to fifty miles off, and of great mean elevation (20,000 feet): the vast snowy mountains that rose beyond it were, I was assured, beyond the Yaru, in the salt lake country.[1] A spur from Chomiomo cut off the view to

[1] This salt country was described to me as enormously lofty, perfectly sterile, and fourteen days' march for loaded men and sheep from Jigatzi; there is no

TIBET AND CHOLAMOO LAKES FROM DONGRA PASS. ELEVATION 18,500 FT.

the southward of north-west, and one from Donkia concealed all to the east of north.

The most remarkable features of this landscape were its enormous elevation, and its colours and contrast to the black, rugged, and snowy Himalaya of Sikkim. All the mountains between Donkia pass and the Arun were comparatively gently sloped, and of a yellow red colour, rising and falling in long undulations like dunes, 2,000 to 3,000 feet above the mean level of the Arun valley, and perfectly bare of perpetual snow or glaciers. Rocks everywhere broke out on their flanks, and often along their tops, but the general contour of that immense area was very open and undulating, like the great ranges of Central Asia, described by MM. Huc and Gabet. Beyond this again, the mountains were rugged, often rising into peaks which, from the angles I took here, and subsequently at Bhomtso, cannot be below 24,000 feet, and are probably much higher. The most lofty mountains were on the range north of Nepal, not less than 120 miles distant, and which, though heavily snowed, were below the horizon of Donkia pass.

Cholamoo lake lay in a broad, scantily grassed, sandy and stony valley; snow-beds, rocks, and glaciers dipped abruptly towards its head, but on its west bank a lofty brick-red spur sloped upwards from it, conspicuously cut into terraces for several hundred feet above its waters.

Kambajong, the chief Tibetan village near this, after Phari and Giantchi, is situated on the Arun (called in Tibet "Chomachoo"), on the road from Sikkim to Jigatzi[1] and Teshoo Loombo. I did

pasture for yaks, whose feet are cut by the rocks. The salt is dug (so they express it) from the margin of lakes; as is the carbonate of soda, "Pieu" of the Tibetans.

[1] I have adopted the simplest mode of spelling this name that I could find, and omitted the zong or jong, which means fort, and generally terminates it. I think it would not be difficult to enumerate fully a dozen ways of spelling the word, of which Shigatzi, Digarchi, and Djigatzi are the most common. The Tibetans tell me that they cross two passes after leaving Donkia, or Kongra Lama, *en route* for Jigatzi, on both of which they suffer from headaches and difficulty of breathing; one is over the Kambajong range; the other, much loftier, is over that of Kiang-lah: as they do not complain of Bhomtso, which is also crossed, and is 18,500 feet, the others may be very lofty indeed. The distance from Donkia pass to Jigatzi is said to be ten days' journey for loaded yaks. Now, according to Turner's observations (evidently taken with great care) that capital is in latitude 29° 4' 20" north, or only seventy miles north of Donkia; and as the yak travels at the rate of sixteen miles a day, the country must be extraordinarily rugged, or the valleys tortuous. Turner took eight or nine days on his journey from Phari to Teshoo Loombo, a distance of only eighty miles; yet he is quoted as an authority for the fact of Tibet being a

not see it, but a long, stony mountain range above the town is very conspicuous, its sides presenting an interrupted line of cliffs, resembling the port-holes of a ship: some fresh fallen snow lay at the base, but none at the top, which was probably 18,500 feet high. The banks of the Arun are thence inhabited at intervals all the way to Tingré, where it enters Nepal.

Donkia rises to the eastward of the pass, but its top is not visible. I ascended (over loose rocks) to between 19,000 and 20,000 feet, and reached vast masses of blue ribboned ice, capping the ridges, but obtained no further prospect. To the west, the beetling east summit of Kinchinjhow rises at two miles distance, 3,000 to 4,000 feet above the pass. A little south of it, and north of Chango Khang, the view extends through a gap in the Sebolah range, across the valley of the Lachen, to Kinchinjunga, distant forty-two miles. The monarch of mountains looked quite small and low from this point, and it was difficult to believe it was 10,000 feet more lofty than my position. I repeatedly looked from it to the high Tibetan mountains in the extreme north-west distance, and was more than ever struck with the apparently immense distance, and consequent altitude of the latter: I put, however, no reliance on such estimates.

To the south the eye wandered down the valley of the Lachoong to the mountains of the Chola range, which appear so lofty from Darjeeling, but from here are sunk far below the horizon: on comparing these with the northern landscape, the wonderful difference between their respective snow levels, amounting to fully 5,000 feet, was very apparent. South-east the stupendous snowy amphitheatre formed by the flank of Donkia was a magnificent spectacle.

This wonderful view forcibly impressed me with the fact, that all eye-estimates in mountainous countries are utterly fallacious, if not corrected by study and experience. I had been led to believe that from Donkia pass the whole country of Tibet sloped away in descending steppes to the Tsampu, and was more or less of a plain; and could I have trusted my eyes only, I should have confirmed this assertion so far as the slope was concerned. When, however, the levelled theodolite was directed to the distance, the

plain! he certainly crossed an undulating country, probably 16,000 to 17,000 feet high; a continuation eastwards of the Cholamoo features, and part of the same mountain range that connects Chumulari and Donkia: he had always lofty mountains in sight, and rugged ones on either side, after he had entered the Painomchoo valley. It is a remarkable and significant fact that Turner never appears to have seen Chumulari after having passed it, nor Donkia, Kinchinjhow, or Kinchinjunga at any time.

reverse was found to be the case. Unsnowed and apparently low mountains touched the horizon line of the telescope; which proves that, if only 37 miles off, they must, from the dip of the horizon, be at least 1,000 feet higher than the observer's position. The same infallible guide cuts off mountain-tops and deeply snowed ridges, which to the unaided eye appear far lower than the point from which they are viewed; but which, from the quantity of snow on them, must be many thousand feet higher, and, from the angle they subtend in the instrument, must be at an immense distance. The want of refraction to lift the horizon, the astonishing precision of the outlines, and the brilliancy of the images of mountains reduced by distance to mere specks, are all circumstances tending to depress them to appearance. The absence of trees, houses, and familiar objects to assist the eye in the appreciation of distance, throws back the whole landscape; which, seen through the rarified atmosphere of 18,500 feet, looks as if diminished by being surveyed through the wrong end of a telescope.

A few rude cairns were erected on the crest of the pass, covered with wands, red banners, and votive offerings of rags. I found a fine slab of slate, inscribed with the Tibetan characters, "Om Mani Padmi hom," which Meepo allowed me to take away, as the reward of my exertions. The ridge is wholly formed of angular blocks of white gneissy granite, split by frost.[1] There was no snow on the pass itself but deep drifts and glaciers descended in hollows on the north side, to 17,000 feet. The rounded northern red shoulder of Kinchinjhow by Cholamoo lake, apparently 19,000 feet high, was quite bare; and, as I have said, I ascended Donkia to upwards of 19,000 feet before I found the rocks crusted with ice,[2] and the ground wholly frozen. I assume, therefore, that 19,000 feet at this spot is not below the mean level at which all the snow melts that falls on a fair exposure to the south: this probably coincides with a mean temperature of 20°. Forty miles further north (in Tibet) the same line is probably at 20,000 feet; for there much less snow falls, and much more melts in propor-

[1] It was not a proper granite, but a highly metamorphic felspathic gneiss, with very little mica; being, I suspect, a gneiss which by metamorphic action was almost remolten into granite: the lamination was obscure, and marked by faint undulating lines of mica; it cleaves at all angles, but most generally along fissures with highly polished undulated black surfaces. The strike of the same rock near at hand was north-west, and dip north-east, at various angles.

[2] Snow, transformed into ice throughout its whole mass: in short, glacial ice in all physical characters.

tion.[1] From the elevation of about 19,300 feet, which I attained on Donkia, I saw a fine illustration of that atmospheric phenomenon called the "spectre of the Brocken," my own shadow being projected on a mass of thin mist that rose above the tremendous precipices over which I hung. My head was surrounded with a brilliant circular glory or rainbow."[2]

The temperature of the Donkia pass is much higher than might be anticipated from its great elevation, and from the fact of its being always bitterly cold to the feelings. This is no doubt due to the warmth of the ascending currents, and to the heat evolved during the condensation of their vapours. I took the following observations :—

			Temp.	D.P.	Difference.	Tension.	Humidity.
Sept.	9	1·30—3·30 P.M.	41° 8	30° 3	11°·5—	0·1876	0·665
,,	27	1·15—3·15 P.M.	49° 2	32° 6	11°·6—	0·2037	0·560
Oct.	19	3·0 —3·30 P.M.	40° 1	25° 0	15°·1—	0·1551	0·585

The first and last of these temperatures were respectively 42° 3 and 46° 4 lower than Calcutta, which, with the proper deduction for latitude, allows 508 and 460 feet as equivalent to 1° Fahr. I left a minimum thermometer on the summit on the 9th of September, and removed it on the 27th, but it had been lifted and turned over by the action of the frost and snow on the loose rocks amongst which I had placed it; the latter appearing to have been completely shifted. Fortunately, the instrument escaped unhurt, with the index at 28°.

A violent southerly wind, with a scud of mist, and sometimes snow, always blew over the pass; but we found shelter on the north face, where I twice kindled a fire, and boiled my ther-

[1] Two secondary considerations materially affecting the melting of snow, and hence exerting a material influence on the elevation of the snow-line, appear to me never to have been sufficiently dwelt upon. Both, however, bear directly upon the great elevation of the snow-line in Tibet. From the imperfect transmission of the heating rays of the sun through films of water, which transmit perfectly the luminous rays, it follows that the direct effect of the rays, in clear sunshine, are very different at equal elevations of the moist outer and dry inner Himalaya. Secondly, naked rock and soil absorb much more heat than surfaces covered with vegetation, and this heat again radiated is infinitely more rapidly absorbed by snow (or other white surfaces) than the direct heat of the sun's rays is. Hence at equal elevations the ground heats sooner, and the snow is more exposed to the heat thus radiated in arid Tibet, than in the wooded and grassed mountains of Sikkim.

[2] Probably caused by spiculæ of ice floating in the atmosphere, the lateral surfaces of which would then have an uniform inclination of 60° : this, according to the observations of Mariotte, Venturi, and Fraunhœfer, being the angle necessary for the formation of halos.

mometers.[1] On one occasion I felt the pulses of my party several times during two hours' repose (without eating); the mean of eight persons was 105°, the extremes being 92° and 120°, and my own 108°.

One flowering plant ascends to the summit; the *Arenaria* one mentioned at p. 351 and 376. The Fescue grass, a little fern (*Woodsia*), and a *Saussurea*[2] ascend very near the summit, and several lichens grow on the top, as *Cladonia vermicularis*, the yellow *Lecidea geographica*, and the orange *L. miniata*;[3] also some barren mosses. At 18,300 feet, I found on one stone only a fine Scotch lichen, a species of *Gyrophora*, the "*tripe de roche*" of Arctic voyagers, and the food of the Canadian hunters; it is also abundant on the Scotch alps.

Before leaving, I took one more long look at the boundless prospect; and, now that its important details were secured, I had leisure to reflect on the impression it produced. There is no loftier country on the globe than that embraced by this view, and no more howling wilderness; well might the Singtam Soubah and every Tibetan describe it as the loftiest, coldest, windiest, and most barren country in the world. Were it buried in everlasting snows, or burnt by a tropical sun, it might still be as utterly sterile; but with such sterility I had long been familiar. Here the colourings are those of the fiery desert or volcanic island, while the climate is that of the poles. Never, in the course of all my wanderings, had my eye rested on a scene so dreary and inhospitable. The "cities of the plain" lie sunk in no more death-like sea than Cholamoo lake, nor the tombs of Petra hewn in more desolate cliffs than those which flank the valley of the Tibetan Arun.

On our return my pony strained his shoulder amongst the rocks; as a remedy, the Lachoong Phipun plunged a lancet into the muscle, and giving me his own animal, rode mine down.[4]

[1] On the 9th of September the boiling-point was 181° 3, and on the 27th, 181° 2. In both observations, I believe the kettle communicated a higher temperature to the thermometer than that of the water, for the elevations deduced are far too low.

[2] A pink-flowered woolly *Saussurea*, and *Delphinium glaciale*, are two of the most lofty plants; both being commonly found from 17,500 to 18,000 feet.

[3] This is one of the most Arctic, Antarctic, and universally diffused plants. The other lichens were *Lecidea atro-alba*, *oreina*, *elegans*, and *chlorophana*, all alpine European and Arctic species. At 17,000 feet occur *Lecanora ventosa*, *physodes*, *candelaria*, *sordida*, *atra*, and the beautiful Swiss *L. chrysoleuca*, also European species.

[4] These animals, called Tanghan, are wonderfully strong and enduring; they

It drizzled and sleeted all the way, and was dark before we arrived at the tent.

At night the Tibetan dogs are let loose, when they howl dismally: on one occasion they robbed me of all my meat, a fine piece of yak's flesh. The yaks are also troublesome, and bad sleepers; they used to try to effect an entrance into my tent, pushing their muzzles under the flaps at the bottom, and awakening me with a snort and moist hot blast. Before the second night I built a turf wall round the tent, and in future slept with a heavy tripod by my side, to poke at intruders.

Birds flock to the grass about Momay; larks, finches, warblers, abundance of sparrows, feeding on the yak-droppings, and occasionally the hoopoe; waders, cormorants, and wild ducks were sometimes seen in the streams, but most of them were migrating south. The yaks are driven out to pasture at sunrise, and home at sunset, till the middle of the month, when they return to Yeumtong. All their droppings are removed from near the tents, and piled in heaps; as these animals, unlike their masters, will not sleep amid such dirt. These heaps swarm with the maggots of two large flies, a yellow and black, affording abundant food to red-legged crows, ravens, and swallows. Butterflies are rare; the few are mostly *Colias*, *Hipparchia*, *Poylommatus*, and *Melitæa*; these I have seen feeding at 17,000 feet; when found higher, they have generally been carried up by currents. Of beetles, an *Aphodeus*, in yak-droppings, and an *Elaphrus*, a predaceous genus inhabiting swamps, are almost the only ones I saw. The wild quadrupeds are huge sheep, in flocks of fifty, the *Ovis Ammon* called "Gnow." I never shot one, not having time to pursue them, for they were very seldom seen, and always at great elevations. The larger marmot is common, and I found the horns of the "Tchiru" antelope. Neither the wild horse, fox, hare, nor tailless rat, cross the Donkia pass. White clover, shepherd's purse, dock, plantain, and chickweed, are imported here by yaks;

are never shod, and the hoof often cracks, and they become pigeon-toed; they are frequently blind of one eye, when they are called "zemik" (blind ones), but this is thought no great defect. They average 5*l.* to 10*l.* for a good animal in Tibet; and the best fetch 40*l.* to 50*l.* in the plains of India, where they become acclimated and thrive well. Giantchi (Jhansi-jeung of Turner) is the best mart for them in this part of Tibet, where some breeds fetch very high prices. The Tibetans give the foals of value messes of pig's blood and raw liver, which they devour greedily, and it is said to strengthen them wonderfully; the custom is, I believe, general in central Asia. Humboldt (Pers. Nar. iv. p. 320) describes the horses of Caraccas as occasionally eating salt meat. ,,

but the common *Prunella* of Europe is wild, and so is a groundsel like *Senecio Jacobæa*, *Ranunculus*, *Sibbaldia*, and 200 other plants. The grasses are numerous; they belong chiefly to *Poa*, *Festuca*, *Stipa*, and other European genera.

I repeatedly attempted to ascend both Kinchinjhow and Donkia from Momay, and generally reached from 18,000 to 19,000 feet, but never much higher.[1] The observations taken on these excursions are sufficiently illustrated by those of Donkia pass; they served chiefly to perfect my map, measure the surrounding peaks, and determine the elevation reached by plants; all of which were slow operations, the weather of this month being so bad that I rarely returned dry to my tent; fog and drizzle, if not sleet and snow, coming on during every day, without exception.

I made frequent excursions to the great glacier of Kinchinjhow. Its valley is about four miles long, broad and flat: Changokhang[2] rears its blue and white cliffs 4,500 feet above its west flank, and throws down avalanches of stones and snow into the valley. Hot springs[3] burst from the ground near some granite rocks on its floor, about 16,000 feet above the sea, and only a mile below the glacier, and the water collects in pools: its temperature is 110°, and in places 116°, or 4° degrees hotter than that of the Yeumtong hot-springs, though 4,000 feet higher, and of precisely the same character. The common winter-cress, *Barbarea vulgaris*, and some other plants make the neighbourhood of the hot-springs a little oasis, and the larger marmot is common, uttering its sharp, chirping squeak.

The terminal moraine is about 500 feet high, quite barren, and thrown obliquely across the valley, from north-east to south-west, completely hiding the glacier. From its top successive smaller

[1] An elevation of 20,000, and perhaps 22,000 feet might, I should think, easily be attained by practice, in Tibet, north of Sikkim.

[2] The elevation of this mountain is about 20,560 feet, by the mean of several observations taken from surrounding localities.

[3] Supposing the mean temperature of the air at the elevation of the Momay springs to be 26° or 28°, which may be approximately assumed, and that, as some suppose, the heat of thermal springs is due to the internal temperature of the globe; then according to the law of increment of heat in descending (of 1° for fifty feet) we should find the temperature of 110° at a depth of 4,100 feet, or at 11,900 feet above the level of the sea. Direct experiment with internal heat has not, however, been carried beyond 2,000 feet below the surface, and as the ratio of increment diminishes with the depth, that above assigned to the temperature of 110° is no doubt much too little. The Momay springs more probably owe their temperature to chemical decomposition of sulphurets of metals. I found pyrites in Tibet on the north flank of the mountain Kinchinjhow, in limestones associated with shales.

parallel ridges (indicating the periodic retirements of the glacier) lead down to the ice, which must have sunk several hundred feet. This glacier descends from Kinchinjhow, the huge cliff of whose eastern extremity dips into it. The surface, less than half a mile wide, is exceedingly undulated, and covered with large holes of water and beds of snow, and is deeply corroded; gigantic blocks are perched on pinnacles of ice on its surface, and the gravel cones[1] are often twenty feet high. The crevassing so conspicuous on the Swiss glaciers is not so regular on this, and the surface appears more like a

GNEISS-BLOCK WITH GRANITE BANDS, ON THE KINCHINJHOW GLACIER.

troubled ocean; due, no doubt, to the copious rain and snow-falls throughout the summer, and the corroding power of wet fogs. The substance of the ice is ribboned, dirt-bands are seen from above to form long loops on some parts, and the lateral moraines, like the terminal, are high above the surface. These notes, made previous to reading Professor Forbes's travels in the Alps, sufficiently show that perpetual snow, whether as ice or glacier, obeys the same laws in India as in Europe; and I have

[1] For a description of this curious phenomenon, which has been illustrated by Agassiz, see "Forbes's Alps," p. 26 and 347.

no remarks to offer on the structure of glaciers, that are not well illustrated and explained in the above-mentioned admirable work.

Its average slope for a mile above the terminal moraines was less than 5°, and the height of its surface above the sea 16,500 feet by boiling-point; the thickness of its ice probably 400 feet. Between the moraine and the west flank of the valley is a large lake, with terraced banks, whose bottom (covered with fine felspathic silt) is several hundred feet above that of the valley; it is half a mile long, and a quarter broad, and fed partly by glaciers of the second order on Chango-khang and Sebolah, and partly by filtration through the lateral moraine.

CHAPTER XXIII.

Donkia glaciers—Moraines—Dome of ice—Honeycombed surface—Rocks of Donkia—Metamorphic action of granite veins—Accident to instruments—Sebolah pass—Bees and May-flies—View—Temperature—Pulses of Party—Lamas and travellers at Momay—Weather and climate—Dr. Campbell leaves Darjeeling for Sikkim—Leave Momay—Yeumtong—Lachoong—Retardation of vegetation at low elevations—Choongtam—Landslips and débacle—Meet Dr. Campbell—Motives for his journey—Second visit to Lachen valley—Autumnal tints—Red currants—Lachen Phipun—Tungu—Scenery—Animals—Poisonous rhododendrons—Fire-wood—Palung—Elevations—Sitong—Kongra Lama—Tibetans—Enter Tibet—Desolate scenery—Plants—Animals—Geology—Cholamoo lakes—Antelopes—Return to Yeumtso—Dr. Campbell lost—Extreme cold—Headaches—Tibetan Dingpun and guard—Arms and accoutrements—Temperature of Yeumtso—Migratory birds—Visit of Dingpun—Yeumtso lakes.

On the 20th of September I ascended to the great Donkia glaciers, east of Momay; the valley is much longer than that leading to the Kinchinjhow glacier, and at 16,000 or 17,000 feet elevation, containing four marshes or lakes, alternating with as many transverse moraines that have dammed the river. These moraines seem in some cases to have been deposited where rocks in the bed of the valley obstructed the downward progress of the ancient glacier; hence, when this latter finally retired, it rested at these obstructions, and accumulated there great deposits, which do not cross the valley, but project from each side obliquely into it. The rocks *in situ* on the floor of the valley are all *moutonnéed* and polished on the top, sides, and face looking up the valley, but are rugged on that looking down it: gigantic blocks are

poised on some. The lowest of the ancient moraines completely crosses the river, which finds its way between the boulders.

Under the red cliff of Forked Donkia the valley becomes very broad, bare, and gravelly, with a confusion of moraines, and turns more northwards. At the angle, the present terminal moraine rises like a mountain (I assumed it to be about 800 feet high),[1] and crosses the valley from N.N.E. to S.S.W. From the summit, which rises above the level of the glacier, and from which I assume its present retirement, a most striking scene opened. The ice filling an immense basin, several miles broad and long, formed a low dome,[2] with Forked Donkia on the west, and a serried range of rusty-red scarped mountains, 20,000 feet high on the north and east, separating large tributary glaciers. Other still loftier tops of Donkia appeared behind these, upwards of 22,000 feet high, but I could not recognize the true summit (23,176 feet). The surface was very rugged, and so deeply honeycombed that the foot often sank from six to eight inches in crisp wet ice. I proceeded a mile on it, with much more difficulty than on any Swiss glacier: this was owing to the elevation, and the corrosion of the surface into pits and pools of water; the crevasses being but few and distant. I saw no dirt-bands on looking down upon it from a point I attained under the red cliff of Forked Donkia, at an elevation of 18,307 feet by barometer, and 18,597 by boiling-point. The weather was very cold, the thermometer fell from 41° to 34°, and it snowed heavily after 3 P.M.

The strike of all the rocks (gneiss with granite veins) seemed

[1] This is the largest and longest terminal moraine backed by an existing glacier that I examined with care: I doubt its being so high as the moraine of the Allalein glacier below the Mat-maark sea in the Sachs valley (Valais, Switzerland); but it is impossible to compare such objects from memory: the Donkia one was much the most uniform in height.

[2] This convexity of the ice is particularly alluded to by Forbes ("Travels in the Alps," p. 386), as the "renflément" of Rendu and "surface bombée" of Agassiz, and is attributed to the effects of hydrostatic pressure tending to press the lower layers of ice upwards to the surface. My own impression at the time was, that the convexity of the surface of the Donkia glacier was due to a subjacent mountain spur running south from Donkia itself. I know, however, far too little of the topography of this glacier to advance such a conjecture with any confidence. In this case, as in all similar ones, broad expanses being covered to an enormous depth with ice, the surface of the latter must in some degree be modified by the ridges and valleys it conceals. The typical "surface bombée," which is conspicuous in the Himalaya glaciers, I was wont (in my ignorance of the mechanical laws of glaciers) to attribute to the more rapid melting of the edges of the glacier by the radiated heat of its lateral moraines and of the flanks of the valley that it occupies.

to be north-east, and dip north-west 30°. Such also were the strike and dip on another spur from Donkia, north of this, which I ascended to 19,000 feet, on the 26th of September : it abutted on the scarped precipices, 3,000 feet high, of that mountain. I had been attracted to the spot by its bright orange-red colour, which I found to be caused by peroxide of iron. The highly crystalline nature of the rocks, at these great elevations, is due to the action of veins of fine-grained granite, which sometimes alter the gneiss to such an extent that it appears as if fused into a fine

SUMMIT OF FORKED DONKIA, AND "GOA" ANTELOPES.

granite, with distinct crystals of quartz and felspar; the most quartzy layers are then roughly crystallised into prisms, or their particles are aggregated into spheres composed of concentric layers of radiating crystals, as is often seen in agates. The re-arrangement of the mineral constituents by heat goes on here just as in trap, cavities filled with crystals being formed in rocks exposed to great heat and pressure. When mica abounds, it becomes black and metallic; and the aluminous matter is crystallised in the form of garnets.

At these great heights the weather was never fine for more than an hour at a time, and driving sleet followed by thick snow drove me down on both these occasions. Another time I ascended a third spur from this great mountain, and was overtaken by a heavy gale and thunderstorm: the latter is a rare phenomenon, it blew down my tripod and instruments which I had thought securely propped with stones, and the thermometers were broken, but fortunately not the barometer. On picking up the latter, which lay with its top down the hill, a large bubble of air appeared, when I passed up and down the tube, and then allowed to escape; when I heard a rattling of broken glass in the cistern. Having another barometer [1] at my tent, I hastened to ascertain by comparison whether the instrument which had travelled with me from England, and taken so many thousand observations, was seriously damaged: to my delight, an error of 0·020 was all I could detect at Momay and all other lower stations. On my return to Darjeeling in December, I took it to pieces, and found the lower part of the bulb of the attached thermometer broken off, and floating on the mercury. Having quite expected this, I always checked the observations of the attached thermometer by another, but—how, it is not easy to say—the broken one invariably gave a correct temperature.

The Kinchinjhow spurs are not accessible to so great an elevation as those of Donkia, but they afford finer views over Tibet, across the ridge connecting Kinchinjhow with Donkia.

Broad summits here, as on the opposite side of the valley, are quite bare of snow at 18,000 feet, though where they project as sloping hog-backed spurs from the parent mountain, the snows of the latter roll down on them and form glacial caps, the reverse of glaciers in valleys, but which overflow, as it were, on all sides of the slopes, and are ribboned [2] and crevassed.

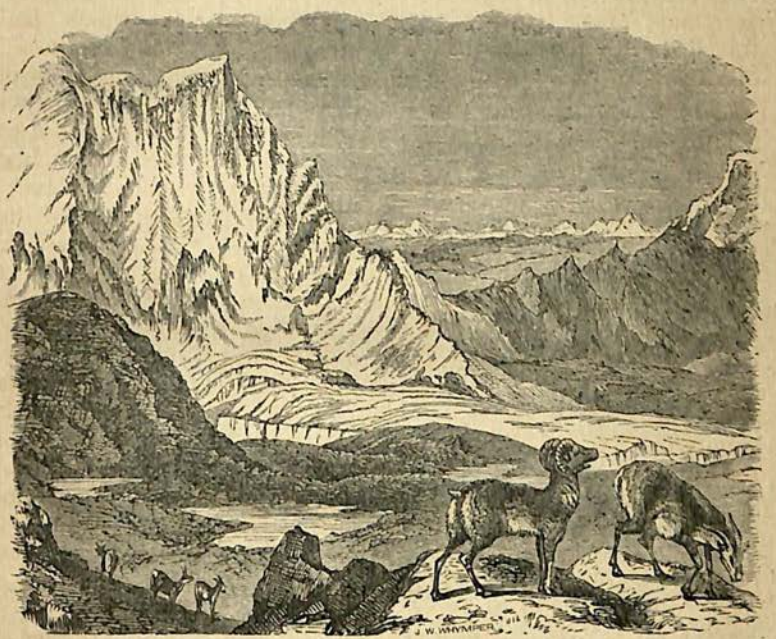
On the 18th of September I ascended the range which divides the Lachen from the Lachoong valley, to the Sebolah pass, a

[1] This barometer (one of Newman's portable instruments) I have now at Kew: it was compared with the Royal Society's standard before leaving England; and varied according to comparisons made with the Calcutta standard 0·012 during its travels; on leaving Calcutta its error was 0; and on arriving in England, by the standard of the Royal Society, +·004. These barometers (though they have obvious defects) are less liable to derangement, far more portable, and stand much heavier shocks than those of any other construction with which I am familiar.

[2] The convexity of the curves, however, seem to be upwards. Such reversed glaciers, ending abruptly on broad stony shoulders quite free of snow, should on no account be taken as indicating the lower limit of perpetual snow.

very sharp ridge of gneiss, striking north-west and dipping north-east, which runs south from Kinchinjhow to Chango-khang. A yak-track led across the Kinchinjhow glacier, along the bank of the lake, and thence westward up a very steep spur, on which was much glacial ice and snow, but few plants above 16,000 feet. At nearly 17,000 feet I passed two small lakes, on the banks of one of which I found bees, a May-fly (*Ephemera*) and gnat; the two latter bred on stones in the water, which (the day being fine) had a temperature of 53°, while that of the large lake at the glacier, 1,000 feet lower, was only 39°.

The view from the summit commands the whole castellated



VIEW FROM AN ELEVATION OF 18,000 FEET OF THE EAST TOP OF KINCHINJHOW, AND OF TIBET, OVER THE RIDGE THAT CONNECTS IT WITH DONKIA. WILD SHEEP (OVIS AMMON) IN THE FOREGROUND.

front of Kinchinjhow, the sweep of the Donkia cliffs to the east, Chango-khang's blunt cone of ribbed snow [1] over head, while to the west, across the grassy Palung dunes rise Chomiomo, the

[1] This ridging or furrowing of steep snow-beds is explained at p. 165.

Thlonok mountains, and Kinchinjunga in the distance.[1] The Palung plains, now yellow with withered grass, were the most curious part of the view: hemmed in by this range which rises 2,000 feet above them, and by the Lachen hills on the east, they appeared a dead level, from which Kinchinjhow reared its head, like an island from the ocean.[2] The black tents of the Tibetans were still there, but the flocks were gone. The broad fosse-like valley of the Chachoo was at my feet, with the river winding along its bottom, and its flanks dotted with black juniper bushes.

The temperature at this elevation, between 1 and 3 P.M., varied from 38° to 59°; the mean being 46°·5, with the dew-point 34°·6. The height I made 17,585 feet by barometer, and 17,517 by boiling-point. I tried the pulses of eight persons after two hours' rest; they varied from 80 to 112, my own being 104. As usual at these heights, all the party were suffering from giddiness and headaches.

Throughout September various parties passed my tent at Momay, generally Lamas or traders: the former, wrapped in blankets, wearing scarlet and gilt mitres, usually rode grunting yaks, which were sometimes led by a slave-boy or a mahogany-faced nun, with a broad yellow sheep-skin cap with flaps over her ears, short petticoats, and striped boots. The domestic utensils, pots, pans, and bamboos of butter, tea-churn, bellows, stools, books, and sacred implements, usually hung rattling on all sides of his holiness, and a sumpter yak carried the tents and mats for sleeping. On several occasions large parties of traders, with thirty or forty yaks[3] laden with planks, passed, and occasionally a shepherd with Tibet sheep, goats, and ponies. I questioned many of these travellers about the courses of the Tibetan rivers; they all agreed[4] in stating the Kambajong or Chomachoo river, north

[1] The latter bore 241° 30′; it was distant about thirty-four miles, and subtended an angle of 3° 2′ 30″. The rocks on its north flanks were all black, while those forming the upper 10,000 feet of the south face were white: hence, the top is probably granite, overlaid by the gneiss on the north.

[2] It is impossible to contemplate the abrupt flanks of all these lofty mountains, without contrasting them with the sloping outlines that prevail in the southern parts of Sikkim. All such precipices are, I have no doubt, the results of sea action; and all posterior influence or sub-aerial action, aqueous or glacial, tends to wear these precipices into slopes, to fill up valleys and to level mountains. Of all such influences heavy rain-falls and a luxuriant vegetation are probably the most active; and these features are characteristic of the lower valleys of Sikkim, which are consequently exposed to very different conditions of wear and tear from those which prevail on these loftier rearward ranges.

[3] About 600 loaded yaks are said to cross the Donkia pass annually.

[4] One lad only, declared that the Kambajong river flowed north-west to

of the Lachen, to be the Arun of Nepal, and that it rose near the Ramchoo lake (of Turner's route). The lake itself discharges either into the Arun, or into the Painomchoo (flowing to the Yaru); but this point I could never satisfactorily ascertain.

The weather at Momay, during September, was generally bad after 11 A.M.: little snow or rain fell, but thin mists and drizzle prevailed; less than one inch and a half of rain was collected, though upwards of eleven fell at Calcutta, and rather more at Darjeeling. The mornings were sometimes fine, cold, and sunny, with a north wind which had blown down the valley all night, and till 9 A.M., when the south-east wind, with fog, came on. Throughout the day a north current blew above the southern; and when the mist was thin, the air sparkled with spiculæ of snow, caused by the cold dry upper current condensing the vapours of the lower. This southern current passes over the tops of the loftiest mountains, ascending to 24,000 feet, and discharging frequent showers in Tibet, as far north as Jigatzi, where, however, violent dry easterly gales are the most prevalent.

The equinoctial gales set in on the 21st, with a falling barometer, and sleet at night; on the 23rd and 24th it snowed heavily, and being unable to light a fire at the entrance of my tent, I spent two wretched days, taking observations; on the 25th it cleared, and the snow soon melted. Frosty nights succeeded, but the thermometer only fell to 31° once during the month, and the maximum once rose to 62°·5. The mean temperature from the 9th to the 30th September was 41°·6,[1] which coincided with that of 8 A.M. and 8 P.M.; the mean maximum, 52°·2, minimum, 34°·7, and consequent range, 17°·5.[2] On seven nights the radiating thermometer fell much below the temperature of the air, the mean being 10°·5 and maximum 14°·2; and on seven mornings the sun heated the black-bulb thermometer considerably, on the mean to 62°·6 above the air; maximum 75°·2, and minimum, 43°. The greatest heat of the day occurred at noon: the

Dobtah and Sarrh, and thence turned north to the Yaru; but all Campbell's itineraries, as well as mine, make the Dobtah lake drain into the Chomachoo, north of Wallanchoon; which latter river the Nepalese also affirm flows into Nepal, as the Arun. The Lachen and Lachoong Phipuns both insisted on this, naming to me the principal towns on the way south-west from Kambajong along the river to Tingri Maidan, *viâ* Tashirukpa Chait, which is north of Wallanchoon pass.

[1] The result of fifty-six comparative observations between Calcutta and Momay give 40°·5 difference, which, after corrections, allows 1° Fahr. for every 438 feet of ascent.

[2] At Darjeeling the September range is only 9°·5; and at Calcutta 10°.

most rapid rise of temperature (5°) between 8 and 9 A.M.; and the greatest fall (5°·5) between 3 and 4 P.M. A sunk thermometer fell from 52°·5 to 51°·5 between the 11th and 14th, when I was obliged to remove the thermometer owing to the accident mentioned above. The mercury in the barometer rose and fell contemporaneously with that at Calcutta and Darjeeling, but the amount of tide was considerably less, and, as is usual during the equinoctial month, on some days it scarcely moved, whilst on others it rose and fell rapidly. The tide amounted to 0·062 of an inch.

On the 28th of the month the Singtam Soubah came up from Yeumtong, to request leave to depart for his home, on account of his wife's illness; and to inform me that Dr. Campbell had left Darjeeling, accompanied (in compliance with the Rajah's orders) by the Tchebu Lama. I therefore left Momay on the 30th, to meet him at Choongtam, arriving at Yeumtong the same night, amid heavy rain and sleet.

Autumnal tints reigned at Yeumtong, and the flowers had disappeared from its heath-like flat; a small eatable cherry with a wrinkled stone was ripe, and acceptable in a country so destitute of fruit.[1] Thence I descended to Lachoong, on the 1st of October, again through heavy rain, the snow lying on the Tunkra mountain at 14,000 feet. The larch was shedding its leaves, which turn red before they fall; but the annual vegetation was much behind that at 14,000 feet, and so many late flowerers, such as *Umbelliferæ* and *Compositæ*, had come into blossom, that the place still looked gay and green: the blue climbing gentian (*Crawfurdia*) now adorned the bushes; this plant would be a great acquisition in English gardens. A *Polygonum* still in flower here, was in ripe fruit near Momay, 6,000 feet higher up the valley.

On the following day I made a long and very fatiguing march to Choongtam, but the coolies were not all able to accomplish it. The backwardness of the flora in descending was even more conspicuous than on the previous day: the jungles, at 7,000 feet, being gay with a handsome Cucurbitaceous plant. Crossing the Lachoong cane-bridge, I paid the tribute of a sigh to the memory of my poor dog, and reached my old camping-ground at Choong-

[1] The absence of edible *Vaccinia* (whortleberries and cranberries) and *Rubi* (brambles) in the alpine regions of the Himalaya is very remarkable, and they are not replaced by any substitutes. With regard to Vaccinium, this is the more anomalous, as several species grow in the temperate regions of Sikkim.

tam by 10 P.M., having been marching rapidly for twelve hours. My bed and tent came up two hours later, and not before the leeches and mosquitos had taxed me severely. On the 4th of October I heard the nightingale for the first time this season.

Expecting Dr. Campbell on the following morning, I proceeded down the river to meet him: the whole valley was buried under a torrent or débacle of mud, shingle, and boulders, and for half a mile the stream was dammed up into a deep lake. Amongst the gneiss and granite boulders brought down by this débacle, I collected some actinolites; but all minerals are extremely rare in Sikkim and I never heard of a gem or crystal of any size or beauty, or of an ore of any consequence, being found in this country.

I met my friend on the other side of the mud torrent, and I was truly rejoiced to see him, though he was looking much the worse for his trying journey through the hot valleys at this season; in fact, I know no greater trial of the constitution than the exposure and hard exercise that is necessary in traversing these valleys, below 5,000 feet, in the rainy season: delay is dangerous, and the heat, anxiety, and bodily suffering from fatigue, insects, and bruises, banish sleep, and urge the restless traveller onward to higher and more healthy regions. Dr. Campbell had, I found, in addition to the ordinary dangers of such a journey, met with an accident which might have proved serious; his pony having been dashed to pieces by falling over a precipice, a fate he barely escaped himself, by adroitly slipping from the saddle when he felt the animal's foot giving way.

On our way back to Choongtam, he detailed to me the motives that had led to his obtaining the authority of the Deputy-Governor of Bengal (Lord Dalhousie being absent) for his visiting Sikkim. Foremost, was his earnest desire to cultivate a better understanding with the Rajah and his officers. He had always taken the Rajah's part, from a conviction that he was not to blame for the misunderstandings which the Sikkim officers pretended to exist between their country and Darjeeling; he had, whilst urgently remonstrating with the Rajah, insisted on forbearance on my part, and had long exercised it himself. In detailing the treatment to which I was subjected, I had not hesitated to express my opinion that the Rajah was more compromised by it than his Dewan: Dr. Campbell, on the contrary, knew that the Dewan was the head and front of the whole system of annoyance. In one point of view it mattered little who was in the right; but the transaction was a violation of good faith on

the part of the Sikkim government towards the British, for which the Rajah, however helpless, was yet responsible. To act upon my representations alone would have been unjust, and no course remained but for Dr. Campbell to inquire personally into the matter. The authority to do this gave him also the opportunity of becoming acquainted with the country which we were bound to protect, as well by our interest as by treaty, but from which we were so jealously excluded, that should any contingency occur, we were ignorant of what steps to take for defence, and, indeed, of what we should have to defend.

On the 6th of October we left Choongtam for my second visit to the Kongra Lama pass, hoping to get round by the Cholamoo lakes and the Donkia pass. As the country beyond the frontier was uninhabited, the Tchebu Lama saw no difficulty in this, provided the Lachen Phipun and the Tibetans did not object. Our great obstacle was the Singtam Soubah, who (by the Rajah's order) accompanied us to clear the road, and give us every facility, but who was very sulky, and undisguisedly rude to Campbell; he was, in fact, extremely jealous of the Lama, who held higher authority than he did, and who alone had the Rajah's confidence.

Our first day's march was of about ten miles to one of the river-flats, which was covered with wild apple-trees, whose fruit, when stewed with sugar, we found palatable. The Lachen river, though still swollen, was comparatively clear; the rains usually ceasing, or at least moderating, in October: its water was about 5° colder than in the beginning of August.

During the second day's march we were stopped at the Taktoong river by the want of a bridge, which the Singtam Soubah refused to exert himself to have repaired; its waters were, however, so fallen, that our now large party soon bridged it with admirable skill. We encamped the second night on Chateng, and the following day made a long march, crossing the Zemu, and ascending half-way to Tallum Samdong. The alpine foliage was rapidly changing colour; and that of the berberry turning scarlet, gave a warm glow to the mountain above the forest. Lamteng village was deserted: turnips were maturing near the houses, and buckwheat on the slope behind; the latter is a winter-crop at lower elevations, and harvested in April. At Zemu Samdong the willow-leaves were becoming sear and yellow, and the rose-bushes bore enormous scarlet hips, two inches long, and covered with bristles; they were sweet, and rather good eating. Near Tungu (where we arrived on the 9th) the great Sikkim currant

was in fruit; its berries are much larger than the English, and of the same beautiful red colour, but bitter and very acid; they are, however, eaten by the Tibetans, who call them "Kewdemah."

Near the village I found Dr. Campbell remonstrating with the Lachen Phipun on the delays and rude treatment I had received in June and July: the man, of course, answered every question with falsehoods, which is the custom of these people, and produced the Rajah's orders for my being treated with every civility, as a proof that he must have behaved as he ought! The Singtam Soubah, as was natural, hung back, for it was owing to him alone that the orders had been contravened, and the Phipun appealed to the bystanders for the truth of this.

The Phipun (accompanied by his Larpun or subordinate officer) had prepared for us a sumptuous refreshment of tea-soup, which was brewing by the road, and in which all animosities were soon washed away. We took up our abode at Tungu in a wooden hut under the great rock, where we were detained for several days by bad weather. I was assured that during all August and September the weather had been uniformly gloomy, as at Momay, though little rain had fallen.

We had much difficulty in purchasing a sufficient number of blankets[1] for our people, and in arranging for our journey, to which the Lachen Phipun was favourable, promising us ponies for the expedition. The vegetation around was wholly changed since my July visit: the rhododendron scrub was verdigris-green from the young leaves which burst in autumn, and expose at the end of each branchlet a flower-bud covered with resinous scales, which are thrown off in the following spring. The jungle was spotted yellow with the withered birch, maple and mountain-ash, and scarlet with berberry bushes; while above, the pastures were yellow-brown with the dead grass, and streaked with snow.

Amongst other luxuries, we procured the flesh of yak calves, which is excellent veal: we always returned the foot for the mother to lick while being milked, without which she yields nothing. The yak goes nine months with calf, and drops one every two years, bearing altogether ten or twelve: the common Sikkim cow of lower elevations, at Darjeeling invariably goes from nine and a half to ten months, and calves annually: ponies go eleven months, and foal nearly every year. In Tibet the sheep are annually sheared; the ewes drop their young in spring and autumn, but the lambs born at the latter period often die of cold.

[1] These were made of goat's wool, teazed into a satiny surface by little teazle-like brushes of bamboo.

and starvation, and double lambing is unknown; whereas, in the plains of Bengal (where, however, sheep cannot be said to thrive without pulse fodder) twins are constantly both. At Darjeeling the sheep drop a lamb once in the season. The Tibetan mutton we generally found dry and stringy.

In these regions many of my goats and kids had died foaming at the mouth and grinding their teeth; and I here discovered the cause to arise from their eating the leaves of *Rhododendron cinnabarinum*[1] ("Kema Kechoong," Lepcha: Kema signifying Rhododendron): this species alone is said to be poisonous; and when used as fuel, it causes the face to swell and the eyes to inflame; of which I observed several instances. As the subject of fire-wood is of every-day interest to the traveller in these regions, I may here mention that the rhododendron wood affords poor fires; juniper burns the brightest, and with least smoke. *Abies Webbiana*, though emitting much smoke, gives a cheerful fire, far superior to larch,[2] spruce, or *Abies Brunoniana*. At Darjeeling, oak is the common fuel; adder is also good. Chestnut is invariably used for blacksmith's charcoal. Magnolia has a disagreeable odour, and laurel burns very badly.

The phenomenon of phosphorescence is most conspicuous on stacks of fire-wood. At Darjeeling, during the damp, warm, summer months (May to October), at elevations of 5,000 to 8,000 feet, it may be witnessed every night by penetrating a few yards into the forest—at least it was so in 1848 and 1849; and during my stay there billets of decayed wood were repeatedly sent to me by residents, with inquiries as to the cause of their luminosity. It is no exaggeration to say that one does not need to move from the fireside to see this phenomenon, for if there is a partially decayed log amongst the fire-wood, it is almost sure to glow with a pale phosphoric light. A stack of fire-wood, collected near my host's (Mr. Hodgson) cottage, presented a beautiful spectacle for two months (in July and August), and on passing it at night, I had to quiet my pony, who was always alarmed by it. The phenomenon invariably accompanies decay, and is common on oak, laurel (*Tetranthera*), birch, and probably other timbers; it equally appears on cut wood and on stumps, but is most frequent on branches lying close to the ground in the wet forests. I have

[1] The poisonous honey produced by other species is alluded to at p. 140. An *Andromeda* and a *Gaultheria*, I have been assured are equally deleterious.

[2] The larch of northern Asia (*Larix Europæa*) is said to produce a pungent smoke, which I never observed to be the case with the Sikkim species.

reason to believe that it spreads with great rapidity from old surfaces to freshly cut ones. That it is a vital phenomenon, and due to the mycelium of a fungus, I do not in the least doubt, for I have observed it occasionally circumscribed by those black lines which are so often seen to bound mycelia on dead wood, and to precede a more rapid decay. I have often tried, but always in vain, to coax these mycelia into developing some fungus, by placing them in damp rooms, &c. When camping in the mountains, I frequently caused the natives to bring phosphorescent wood into my tent, for the pleasure of watching its soft undulating light, which appears to pale and glow with every motion of the atmosphere; but except in this difference of intensity, it presents no change of appearance night after night. Alcohol, heat and dryness soon dissipate it; electricity I never tried. It has no odour, and my dog, who had a fine sense of smell, paid no heed when it was laid under his nose.[1]

The weather continuing bad, and snow falling, the country people began to leave for their winter quarters at Lamteng. In the evenings we enjoyed the company of the Phipun and Tchebu Lama, who relished a cup of sugarless tea more than any other refreshment we could offer. From them we collected much Tibetan information:—the former was an inveterate smoker, using a pale, mild tobacco, mixed largely with leaves of the small wild Tibetan Rhubarb, called "Chula." Snuff is little used, and is principally procured from the plains of India.

We visited Palung twice, chiefly in hopes that Dr. Campbell might see the magnificent prospect of Kinchinjhow from its plains: the first time we gained little beyond a ducking, but on the second (October the 15th) the view was superb; and I likewise caught a glimpse of Kinchinjunga from the neighbouring heights, bearing south 60° west and distant forty miles. I also measured barometrically the elevation at the great chait on the plain, and found it 15,620 feet, and by carefully boiled thermometers, 15,283, on the 13th October, and 15,566 on the 15th: the difference being due

[1] As far as my observations go, this phenomenon of light is confined to the lower orders of vegetable life, to the fungi alone, and is not dependent on irritability. I have never seen luminous flowers or roots, nor do I know of any authenticated instance of such, which may not be explained by the presence of mycelium or of animal life. In the animal kingdom, luminosity is confined, I believe, to the Invertebrata, and is especially common amongst the Radiata and Mollusca; it is also frequent in the Entromostracous Crustacea, and in various genera of most orders of insects. In all these, as in the Sertulariæ, I have invariably observed the light to be increased by irritation, in which respect the luminosity of animal life differs from that of vegetable.

to the higher temperature on the latter day, and to a rise of 0°3 on both boiling-point thermometers above what the same instruments stood at on the 13th. The elevation of Tungu from the October barometrical observations was only seven feet higher than that given by those of July; the respective heights being 12,766 feet in July, and 12,773 in October.[1] The mean temperature had fallen from 50° in July to 41°, and that of the sunk thermometer from 57° to 51° 4. The mean range in July was 23° 3, and in October 13° 8; the weather during the latter period being, however, uniformly cold and misty, this was much below the mean monthly range, which probably exceeds 30°. Much more rain fell in October at Tungu than at Darjeeling, which is the opposite to what occurs during the rainy season.

October 15th. Having sent the coolies forward, with instructions to halt and camp on this side the Kongra Lama pass, we followed them, taking the route by Palung, and thence over the hills to the Lachen, to the east of which we descended, and further up its valley joined the advanced party in a rocky glen, called Sitong, an advantageous camping ground, from being sheltered by rocks which ward off the keen blasts: its elevation is 15,370 above the sea, and the magnificent west cliff of Kinchinjhow towers over it not a mile distant, bearing due east, and subtending an angle of 24° 3′. The afternoon was misty, but at 7 P.M. the south-east wind fell, and was immediately succeeded by the biting north return current, which dispelled the fog: hoar-frost sparkled on the ground, and the moon shone full on the snowy head of Kinchinjhow, over which the milky-way and the broad flashing orbs of the stars formed a jewelled diadem. The night was very windy and cold, though the thermometer fell no lower than 22°, that placed in a polished paraboiic reflector to 20°, and another laid on herbage to 17° 5.

On the 16th we were up early. I felt very anxious about the prospect of our getting round by Donkia pass and Cholamoo, which would enable me to complete the few remaining miles of my long survey of the Teesta river, and which promised immense results in the views I should obtain of the country, and of the

[1] The elevation of Tungu by boiling point was 12,650 feet by a set of July observations, 12,818 by a set taken on the 11th of October, and 12,544 by a set on the 14th of October: the discrepancies were partly due to the temperature corrections, but mainly to the readings of the thermometers, which were—

July 28 sunset	189·5	air 47° 3	elev.	12,650
Oct. 11 noon	189·5	,, 37° 6	,,	12,818
Oct. 14 sunset	190·1	,, 45° 3	,,	12,544

geology and botany of these lofty snowless regions. Campbell, though extremely solicitous to obtain permission from the Tibetan guard (who were waiting for us on the frontier), was nevertheless bound by his own official position to yield at once to their wishes, should they refuse us a passage.

The sun rose on our camp at 7.30 A.M., when the north wind fell; and within an hour afterwards the temperature had risen to 45°. Having had our sticks[1] warmed and handed to us, we started on ponies, accompanied by the Lama only, to hold a parley with the Tibetans; ordering the rest of the party to follow at their leisure. We had not proceeded far when we were joined by two Tibetan Sepoys, who, on our reaching the pass, bellowed lustily for their companions; when Campbell and the Lama drew up at the chait of Kongra Lama, and announced his wish to confer with their commandant.

My anxiety was now wound up to a pitch; I saw men with matchlocks emerging from amongst the rocks under Chomiomo, and despairing of permission being obtained, I goaded my pony with heels and stick, and dashed on up the Lachen valley, resolved to make the best of a splendid day, and not turn back till I had followed the river to the Cholamoo lakes. The Sepoys followed me a few paces, but running being difficult at 16,000 feet, they soon gave up the chase.

A few miles ride in a north-east direction over an open, undulating country, brought me to the Lachen, flowing westwards in a broad, open, stony valley, bounded by Kinchinjhow on the south (its face being as precipitous as that on the opposite side), and on the north by the Peukathlo, a low range of rocky, sloping mountains, of which the summits were 18,000 to 19,000 feet above the sea. Enormous erratic blocks of gneiss strewed the ground, which was sandy or gravelly, and cut into terraces along the shallow, winding river, the green and sparkling waters of which rippled over pebbles, or expanded into lagoons. The already scanty vegetation diminished rapidly: it consisted chiefly of scattered bushes of a dwarf scrubby honeysuckle and tufts of nettle, both so brittle as to be trodden into powder, and the short leafless twiggy *Ephedra*, a few inches higher. The most alpine rhododendron (*R. nivale*) spread its small rigid branches close to the ground; the hemi-

[1] It was an invariable custom of our Lepcha and Tibetan attendants, to warm the handles of our sticks in cold weather, before starting on our daily marches. This is one of many little instances I could adduce, of their thoughtfulness and attention to the smallest comforts of the stranger and wanderer in their lands.

spherical *Arenaria*, another type of sterility, rose here and there, and tufts of *Myosotis*, *Artemisia*, *Astragali* and *Androsace*, formed flat cushions level with the soil. Grass was very scarce, but a running wiry sedge (*Carex Moorcroftii*) bound the sand, like the *Carex arenaria* of our English coasts.

A more dismally barren country cannot well be conceived, nor one more strongly contrasting with the pastures of Palung at an equal elevation. The long lofty wall of Kinchinjhow and Donkia presents an effectual barrier to the transmission of moisture to the head of the Lachen valley, which therefore becomes a type of such elevations in Tibet. As I proceeded, the ground became still more sandy, chirping under the pony's feet; and where harder, it was burrowed by innumerable marmots, foxes, and the "Goomchen," or tailless rat (*Lagomys badius*), sounding hollow to the tread, and at last becoming so dangerous that I was obliged to dismount and walk.

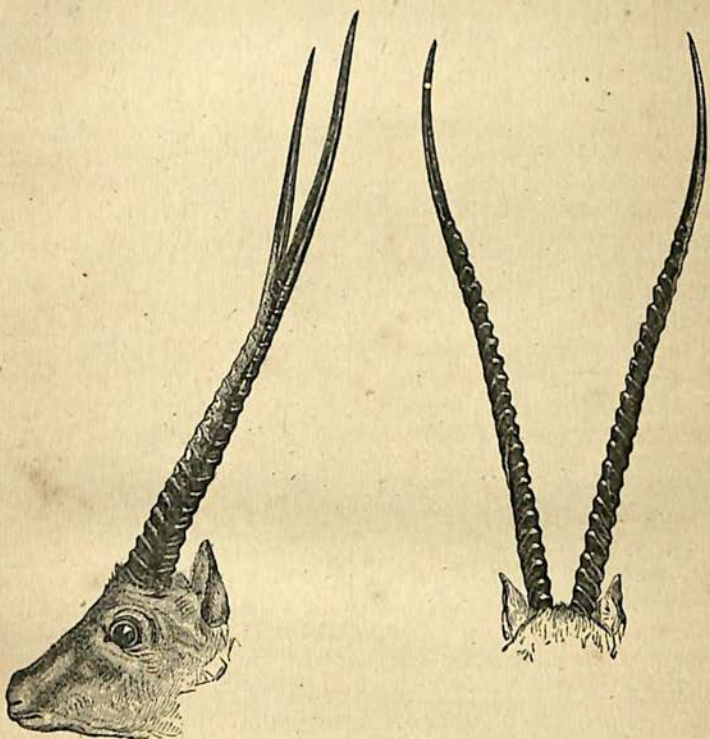
The geological features changed as rapidly as those of the climate and vegetation, for the strike of the rocks being north-west, and the dip north-east, I was rising over the strata that overlie the gneiss. The upper part of Kinchinjhow is composed of bold ice-capped cliffs of gneiss; but the long spurs that stretch northwards from it are of quartz, conglomerates, slates, and earthy red clays, forming the rounded terraced hills I had seen from Donkia pass. Between these spurs were narrow valleys, at whose mouths stupendous blocks of gneiss rest on rocks of a much later geological formation.

Opposite the most prominent of these spurs the river (16,800 feet above the sea) runs west, forming marshes, which were full of *Zannichellia palustris* and *Ranunculus aquatilis*, both English and Siberian plants: the waters contained many shells, of a species of *Lymnæa*;[1] and the soil near the edge, which was covered with tufts of short grass, was whitened with effloresced carbonate of soda. Here were some square stone enclosures two feet high, used as pens, and for pitching tents in; within them I gathered some unripe barley.

"Beyond this I recognised a hill of which I had taken bearings from Donkia pass, and a few miles further, on rounding a spur of Kinchinjunga, I arrived in sight of Cholamoo lakes, with the Donkia mountain rearing its stupendous precipices of rock and ice on the east. My pony was knocked up, and I felt very giddy

[1] This is the most alpine living shell in the world; my specimens being from nearly 17,000 feet elevation; it is the *Lymnæa Hookeri*, Reeve ("Proceedings of the Zoological Society," No. 204).

from the exertion and elevation; I had broken his bridle, and so led him on by my plaid for the last few miles to the banks of the lake; and there, with the pleasant sound of the waters rippling at my feet, I yielded for a few moments to those emotions of gratified ambition which, being unalloyed by selfish considerations for



CHIRU ANTELOPE; "UNICORN" OF TIBET.[1]

the future, become springs of happiness during the remainder of one's life.

The landscape about Cholamoo lake was simple in its elements, stern and solemn; and though my solitary situation rendered it doubly impressive to me, I doubt whether the world contains any

[1] The accompanying figures of the heads of the Chiru (Antilope Hodgsoni) were sketched by Lieut. Maxwell (of the Bengal Artillery), from a pair brought to Darjeeling; it is the so-called unicorn of Tibet, and of MM. Huc and Gabet's narrative,—a name which the profile no doubt suggested.

scene with more sublime associations than this calm sheet of water, 17,000 feet above the sea, with the shadows of mountains 22,000 to 24,000 feet high, sleeping on its bosom.

There was much short grass about the lake, on which large antelopes, "Chiru" (*Antilope Hodgsoni*),[1] and deer, "Goa" (*Procapra picticaudata*, Hodgson), were feeding. There were also many slate-coloured hairs with white rumps (*Lepus oiostolus*), with marmots and tail-less rats. The abundance of animal life was wonderful, compared with the want of it on the south side of the Donkia pass, not five miles distant in a straight line! it is partly due to the profusion of carbonate of soda, of which all ruminants are fond, and partly to the dryness of the climate, which is favourable to all burrowing quadrupeds. A flock of common English teal were swimming in the lake, the temperature of which was 55°.

I had come about fifteen miles from the pass, and arrived at 1 P.M., remaining half an hour. I could not form an idea as to whether Campbell had followed or not, and began to speculate on the probability of passing the night in the open air, by the warm side of my steed. Though the sun shone brightly, the wind was bitterly cold, and I arrived at the stone dykes of Yeumtso at 3 P.M., quite exhausted with fatigue and headache. I there found, to my great relief, the Tchebu Lama and Lachen Phipun: they were in some alarm at my absence, for they thought I was not aware of the extreme severity of the temperature on the north side of the snows, or of the risk of losing my way; they told me that after a long discourse with the Dingpun (or commander) of the Tibetan Sepoys, the latter had allowed all the party to pass; that the Sepoys had brought on the coolies, who were close behind, but that they themselves had seen nothing of Campbell; of whom the Lama then went in search.

The sun set behind Chomiomo at 5 P.M., and the wind at once dropped; so local are these violent atmospheric currents, which are caused by the heating of the upper extremities of these lofty valleys, and consequent rarefaction of the air. Intense terrestrial radiation immediately follows the withdrawal of the sun's rays, and the temperature sinks rapidly.

Soon after sunset the Lama returned, bringing Campbell; who, having mistaken some glacier-fed lakes at the back of Kinchinjhow for those of Cholamoo, was looking for me. He too

[1] I found the horns of this animal on the south side of the Donkia pass, but I never saw a live one except in Tibet. The *Procapra* is described by Mr. Hodgson, "Bengal As. Soc. Jour., 1846, p. 338," and is introduced into the cut at p. 387.

had speculated on having to pass the night under a rock, with one plaid for himself and servant; in which case I am sure they would both have been frozen to death, having no pony to lie down beside. He told me that after I had quitted Kongra Lama, leaving him with the Tchebu Lama and Phipun, the Dingpun and twenty men came up, and very civilly but formally forbade their crossing the frontier; but that upon explaining his motives, and representing that it would save him ten days' journey, the Dingpun had relented, and promised to conduct the whole party to the Donkia pass.

We pitched our little tent in the corner of the cattle-pen, and our coolies soon afterwards came up; mine were in capital health, though suffering from headaches, but Campbell's were in a distressing state of illness and fatigue, with swollen faces and rapid pulses, and some were insensible from symptoms like pressure on the brain[1]; these were chiefly Ghorkas (Nepalese). The Tibetan Dingpun and his guard arrived last of all: he was a droll little object, short, fat, deeply marked with small-pox, swarthy, and greasy; he was robed in a green woollen mantle, and was perched on the back of a yak, which also carried his bedding, and cooking utensils, the latter rattling about its flanks, horns, neck, and every point of support: two other yaks bore the tents of the party. His followers were tall savage looking fellows, with broad swarthy faces, and their hair in short pig-tails. They wore the long-sleeved cloak, short trousers, and boots, all of thick woollen, and felt caps on their heads. Each was armed with a long matchlock slung over his back, with a moveable rest having two prongs like a fork, and a hinge, so as to fold up along the barrel, when the prongs project behind the shoulders like antelope horns, giving the uncouth warrior a droll appearance. A dozen cartridges, each in an iron case, were slung round the waist, and they also wore the long knife, flint, steel, and iron tobacco-pipe, pouch, and purse, suspended to a leathern girdle.

The night was fine, but intensely cold, and the vault of heaven was very dark, and blazing with stars; the air was electrical, and flash lightning illumined the sky; this was the reflection of a storm

[1] I have never experienced bleeding at the nose, ears, lips, or eyelids, either in my person or that of my companions, on these occasions; nor did I ever meet with a recent traveller who has. Dr. Thomson has made the same remark, and when in Switzerland together we were assured by Auguste Balmat, François Coutet, and other experienced Mont Blanc guides, that they never witnessed these symptoms nor the blackness of the sky, so frequently insisted upon by alpine travellers.

that was not felt at Darjeeling, but which raged on the plains of India, beyond the Terai, fully 120 miles, and perhaps 150, south of our position. No thunder was heard. The thermometer fell to 5°, and that in the reflector to 3° 5; at sunrise it rose to 10°, and soon after 8 A.M. to 33°; till this hour the humidity was great, and a thin mist hung over the frozen surface of the rocky ground; when this dispersed, the air became very dry, and the black-bulb thermometer in the sun rose 60° above the temperature in the shade. The light of the sun, though sometimes intercepted by vapours aloft, was very brilliant.[1]

This being the migrating season, swallows flitted through the air; finches, larches, and sparrows were hopping over the sterile soil, seeking food, though it was difficult to say what. The geese[2] which had roosted by the river, cackled; the wild ducks quacked and plumed themselves; ouzels and waders screamed or chirped; and all rejoiced as they prepared themselves for the last flight of the year, to the valleys of the southern Himalaya, to the Teesta, and other rivers of the Terai and plains of India.

The Dingpun paid his respects to us in the morning, wearing, besides his green cloak, a white cap with a green glass button, denoting his rank; he informed us that he had written to his superior officer at Kambajong, explaining his motives for conducting us across the frontier, and he drew from his breast a long letter, written on *Daphne*[3] paper, whose ends were tied with floss silk, with a large red seal; this he pompously delivered, with whispered orders, to an attendant, and sent him off. He admired

[1] My black glass photometer shut out the sun's disc at 10.509 inches, from the mean of four sets of observations taken between 7 and 10 A.M.

[2] An enormous quantity of water-fowl breed in Tibet, including many Indian species that migrate no further north. The natives collect their eggs for the markets at Jigatzi, Giantchi, and Lhassa, along the banks of the Yaru river, Ramchoo, and Yarbru and Dochen lakes. Among other birds the Sara, or great crane of India (see "Turner's Tibet," p. 212), repairs to these enormous elevations to breed. The fact of birds characteristic of the tropics dwelling for months in such climates is a very instructive one, and should be borne in mind in our speculations upon the climate supposed to be indicated by the imbedded bones of birds.

[3] Most of the paper used in Tibet is, as I have elsewhere noticed, made from the bark of various species of *Daphneæ*, and especially of *Edgeworthia Gardneri*, and is imported from Nepal and Bhotan; but the Tibetans, as MM. Huc and Gabet correctly state, manufacture a paper from the root of a small shrub: this I have seen, and it is of a much thicker texture and more durable than Daphne paper. Dr. Thomson informs me that a species of *Astragalus* is used in western Tibet for this purpose, the whole shrub, which is dwarf, being reduced to pulp.

our clothes extremely,[1] and then my percussion gun, the first he had seen; but above all he admired rum and water, which he drank with intense relish, leaving a mere sip for his comrades at the bottom of his little wooden cup, which they emptied, and afterwards licked clean, and replaced in his breast for him. We made a large basin full of very weak grog for his party, who were all friendly and polite; and having made us the unexpected offer of allowing us to rest ourselves for the day at Yeumtso, he left us, and practised his men at firing at a mark, but they were very indifferent shots.

I ascended with Campbell to the lake he had visited on the previous day, about 600 or 800 feet above Yeumtso, and 17,500 feet above the sea: it is a mile and a half long, and occupies a large depression between two rounded spurs, being fed by glaciers from Kinchinjhow. The rocks of these spurs were all of red quartz and slates, cut into broad terraces, covered with a thick glacial talus of gneiss and granite in angular pebbles, and evidently spread over the surface when the glacier, now occupying the upper end of the lake, extended over the valley.

The ice on the cliffs and summit of Kinchinjhow was much greener and clearer than that on the south face (opposite Palung); and rows of immense icicles hung from the cliffs. A conferva grew in the waters of the lake, and short hard tufts of sedge on the banks, but no other plants were to be seen. Brahminee geese, teal, and widgeon, were swimming in the waters, and a beetle (*Elaphrus*) was coursing over the wet banks; finches and other small birds were numerous, eating the sedge-seeds, and picking up the insects. No view was obtained to the north, owing to the height of the mountains on the north flank of the Lachen.

At noon the temperature rose to 52° 5, and the black-bulb to 104° 5; whilst the north-west dusty wind was so dry, that the dew-point fell to 24° 2.

[1] All Tibetans admire and value English broad-cloth beyond any of our products. Woollen articles are very familiar to them, and warm clothing is one of the first requisites of life.

CHAPTER XXIV.

Ascent of Bhomtso—View of snowy mountains—Chumulari—Arun river—Kiang-lah mountains—Jigatzi—Lhassa—Dingcham province of Tibet—Misapplication of term "Plain of Tibet"—Sheep, flocks of—Crops—Probable elevation of Jigatzi—Yaru-Tsampu river—Tame elephants—Wild horses—Dryness of air—Sunset beams—Rocks of Kinchinjhow—Cholamoo lakes—Limestone—Dip and strike of rocks—Effects of great elevation on party—Ascent of Donkia—Moving piles of débris—Cross Donkia pass—Second visit to Momay Samdong—Hot springs—Descent to Yeumtong—Lachoong—Retardation of vegetation again noticed—Jerked meat—Fish—Lose a thermometer—Lepcha lad sleeps in hot spring—Keadom—*Bucklandia*—Arrive at Choongtam—Mendicant—Meepo—Lachen-Lachoong river—Wild grape—View from Singtam of Kinchinjunga—Virulent nettle.

In the afternoon we crossed the valley, and ascended Bhomtso, fording the river, the temperature was 48°. Some stupendous boulders of gneiss from Kinchinjhow are deposited in a broad sandy track on the north bank, by ancient glaciers, which once crossed this valley from Kinchinjhow.

The ascent was alternately over steep rocky slopes, and broad shelf-like flats; many more plants grew here than I had expected, in inconspicuous scattered tufts.[1] The rocks were nearly vertical strata of quartz, hornstone, and conglomerate, striking north-west, and dipping south-west 80°. The broad top of the hill was also of quartz, but covered with angular pebbles of the rocks transported from Kinchinjhow. Some clay-stone fragments were stained red with oxide of iron, and covered with *Parmelia miniata*;[2] this, with *Borrera*, another lichen, which forms stringy masses blown along by the wind, were the only plants, and they are among the most alpine in the world.

[1] Besides those before mentioned, there was Fescue-grass (*Festuca ovina* of Scotland), a strong-scented silky wormwood (*Artemisia*), and round tufts of *Oxytropis chiliophylla*, a kind of *Astragalus* that inhabits eastern and western Tibet; this alone was green: it formed great circles on the ground, the centre decaying, and the annual shoots growing outwards, and thus constantly enlarging the circle. A woolly *Leontopodium*, *Androsace*, and some other plants assumed nearly the same mode of growth. The rest of the vegetation consisted of a *Sedum*, *Nardostachys Jatamansi*, *Meconopsis horridula*, a slender *Androsace*, *Gnaphalium*, *Stipa*, *Salvia*, *Draba*, *Pedicularis*, *Potentilla* or *Sibbaldia*, *Gentiana* and *Erigeron alpinus* of Scotland. All these grow nearly up to 18,000 feet.

[2] This minute lichen, mentioned at p. 381, is the most Arctic, Antarctic, and Alpine in the world; often occurring so abundantly as to colour the rocks of an orange red. This was the case at Bhomtso, and is so also in Cockburn Island in the Antarctic ocean, which it covers so profusely that the rocks look as if brightly painted. See "Ross's Voyage," vol. ii. p. 339.

CHOLAMOO LAKE AND LACHEN RIVER, FROM BOMTSO.

Bhomtso is 18,590 feet above the sea by barometer, and 18,305 by boiling-point: it presented an infinitely more extensive prospect than I had ventured to anticipate, commanding all the most important Sikkim, North Bhotan, and Tibetan mountains, including Kinchinjunga thirty-seven miles to the south-west, and Chumulari thirty-nine miles south-east. Due south, across the sandy valley of the Lachen, Kinchinjhow reared its long wall of glaciers and rugged precipices, 22,000 feet high, and under its cliffs lay the lake to which we had walked in the morning: beyond Kongra Lama were the Thlonok mountains, where I had spent the month of June, with Kinchinjunga in the distance. Westward Chomiomo rose abruptly from the rounded hills we were on, to 22,000 feet elevation, ten miles distant. To the east of Kinchinjhow were the Cholamoo lakes, with the rugged mass of Donkia stretching in cliffs of ice and snow continuously southwards to forked Donkia, which overhangs Momay Samdong.

A long sloping spur sweeps from the north of Donkia first north, and then west to Bhomtso, rising to a height of more than 20,000 feet without snow. Over this spur the celebrated Chumulari[1] peeps, bearing south-east, and from its isolated

[1] Some doubt still hangs over the identity of this mountain, chiefly owing to Turner's having neglected to observe his geographical position. I saw a much loftier mountain than this, bearing from Bhomtso north 87° east, and it was called Chumulari by the Tibetan Sepoys; but it does not answer to Turner's description of an isolated snowy peak, such as he approached within three miles; and though in the latitude he assigned to it, is fully sixty miles to the east of his route. A peak, similar to the one he describes, is seen from Tonglo and Sinchul (see pp. 85 and 129); this is the one alluded to above, and it is identified by both Tibetans and Lepchas at Darjeeling as the true Chumulari, and was measured by Colonel Waugh, who placed it in lat. 27° 49′ north long. 89° 18′ east. The latter position, though fifteen miles south of what Turner gives it, is probably correct; as Pemberton found that Turner had put other places in Bhotan twenty miles too far north. Moreover, in saying that it is visible from Purnea in the plains of Bengal, Turner refers to Kinchinjunga, whose elevation was then unknown. Dr. Campbell ("Bengal As. Soc. Jour.," 1848), describes Chumulari from oral information, as an isolated mountain encircled by twenty-one goompas, and perambulated by pilgrims in five days; the Lachoong Phipun, on the other hand, who was a Lama, and well acquainted with the country, affirmed that Chumulari has many tops, and cannot be perambulated; but that detached peaks near it may be, and that it is to a temple near one of these that pilgrims resort. Again, the natives use these names very vaguely, and as that of Kinchinjunga is often applied equally to all or any part of the group of snows between the Lachen and Tambur rivers, so may the term Chumulari have been used vaguely to Captain Turner or to me. I have been told that an isolated, snow-topped, venerated mountain rises about twenty miles south of the true Chumulari, and is called "Sakya-khang" (Sakya's snowy mountain), which may be that seen

position and sharpness looking low and small; it appeared quite near, though thirty-nine miles distant.

North-east of Chumulari, and far beyond it, are several meridional ranges of very much loftier snowy mountains, which terminated the view of the snowy Himalaya; the distance embraced being fully 150 miles, and perhaps much more. Of one of these eastern masses [1] I afterwards took bearings and angular heights from the Khasia mountains, in Bengal, upwards of 200 miles south-east of its position.

Turning to the northward, a singular contrast in the view was presented: the broad sandy valley of the Arun lay a few miles off, and perhaps 1,500 feet below me; low brown and red ridges, 18,000 to 19,000 feet high, of stony sloping mountains with rocky tops, divided its feeders, which appeared to be dry, and to occupy flat sandy valleys. For thirty miles north no mountain was above the level of the theodolite, and not a particle of snow was to be seen: beyond that, rugged purple-flanked and snowy-topped mountains girdled the horizon, appearing no nearer than they did from the Donkia pass, and their angular heights and bearings being almost the same as from that point of view. The nearer of these are said to form the Kiang-lah chain, the furthest I was told by different authorities are in the salt districts north of Jigatzi.

To the north-east was the lofty region traversed by Turner on his route by the Ramchoo lakes to Teshoo Loombo; its elevation may be 17,000 feet [2] above the sea. Beyond it a gorge led

from Darjeeling; but I incline to consider Campbell's and Waugh's mountain as the one alluded to by Turner, and it is to it that I here refer as bearing north 115° 30′ east from Bhomtso.

[1] These are probably the Ghassa mountains of Turner's narrative: bearings which I took of one of the loftiest of them, from the Khasia mountains, together with those from Bhomtso, would appear to place it in latitude 28° 10′ and longitude 90°, and 200 miles from the former station, and 90° east of the latter. Its elevation from Bhomtso angles is 24,160 feet. I presume I also saw Chumulari from the Khasia; the most western peak seen thence being in the direction of that mountain. Captain R. Strachey has most kindly paid close attention to these bearings and distances, and recalculated the distances and heights: no confidence is, however, to be placed in the results of such minute angles, taken from immense distances. Owing in part no doubt to extraordinary refraction, the angles of the Ghassa mountain taken from the Khasia give it an elevation of 26,500 feet! which is very much over the truth; and make that of Chumulari still higher: the distance from my position in the Khasia being 210 miles from Chumulari! which is probably the utmost limit at which the human eye has ever discerned a terrestrial object.

[2] It is somewhat remarkable that Turner nowhere alludes to difficulty of breathing, and in one place only to head-ache (p. 209) when at these great elevations. This is in a great measure accounted for by his having been

BHOTAN HIMALAYA (DISTANT 120 MILES), LOOKING ACROSS THE ASSAM VALLEY AND BURRAMPOOTER RIVER.

through rugged mountains, by which I was told the Pianom river flows north-west to the Yaru; and at an immense distance to the north-east were the Khamba mountains, a long blue range, which it is said divides the Lhassan or "U" from the "Tsang" (or Jigatzi) province of Tibet; it appeared fully 100 miles off, and was probably much more; it bore from No. 57° E. to N. 70 E., and though so lofty as to be heavily snowed throughout, was much below the horizon line of Bhomtso; it is crossed on the route from Jigatzi, and from Sikkim to Lhassa,[1] and is considered very lofty, from affecting the breathing. About twenty miles to the north-east are some curious red conical mountains, said to be on the west side of the Ramchoo lakes; they were unsnowed, and bore N. 45° 30′ E. and N. 60° 30′ E. A sparingly-snowed group bore N. 26° 30′ E., and another N. 79° E., the latter being probably that mentioned by Turner as seen by him from near Giantchi.

But the mountains which appeared both the highest and the most distant on the northern landscape, were those I described when at Donkia, as being north of Nepal and beyond the Arun river, and the culminant peak of which bore N 55° W. Both Dr. Campbell and I made repeated estimates of its height and distance by the eye; comparing its size and snow-level with those of the mountains near us: and assuming 4,000 to 5,000 feet as the minimum height of its snowy cap; this would give it an elevation of 23,000 to 25,000 feet. An excellent telescope brought out no features on its flanks not visible to the naked eye, and by the most careful levellings with the theodolite, it was depressed more than 0° 7′ below the horizon of Bhomtso, whence the distance must be above 100 miles.

The transparency of the pale-blue atmosphere of these lofty regions can hardly be described, nor the clearness and precision with which the most distant objects are projected against the sky. From having afterwards measured peaks 200 and 210 miles distant from the Khasia mountains, I feel sure that I underrated the estimates that I made at Bhomtso, and I have no hesitation in saying, that the mean elevation of the sparingly-snowed[2]

constantly mounted. I never suffered either in my breathing, head, or stomach when riding, even when at 18,300 feet.

[1] Lhassa, which lies north-east, may be reached in ten days from this, with relays of ponies; many mountains are crossed, where the breath is affected, and few villages are passed after leaving Giantchi, the "Jhansi jeung" of Turner's narrative. See Campbell's "Routes from Darjeeling to Lhassa." ("Bengal As. Soc. Journal.")

[2] Were the snow-level in Dingcham as low as it is in Sikkim, the whole of

watershed between the Yaru and the Arun will be found to be greater than that of the snowy Himalaya south of it, and to follow the chain running from Donkia, north of the Arun, along the Kiang-lah mountains, towards the Nepal frontier, at Tingri Maidan. No part of that watershed perhaps rises so high as 24,000 feet, but its lowest elevation is probably nowhere under 18,000 feet.

This broad belt of lofty country, north of the snowy Himalaya, is the Dingcham province of Tibet, and runs along the frontier of Sikkim, Bhotan, and Nepal. It gives rise to all the Himalayan rivers, and its mean elevation is probably 15,000 to 15,500 feet: its general appearance, as seen from greater heights, is that of a much less mountainous country than the snowy and wet Himalayan regions; this is because its mean elevation is so enormous, that ranges of 20,000 to 22,000 feet appear low and insignificant upon it. The absence of forest and other obstruction to the view, the breadth and flatness of the valleys, and the undulating character of the lower ranges that traverse its surface, give it a comparatively level appearance, and suggest the term "maidan" or "plains" to the Tibetan, when comparing his country with the complicated ridges of the deep Sikkim valleys. Here one may travel for many miles without rising or falling 3,000 feet, yet never descending below 14,000 feet, partly because the flat winding valleys are followed in preference to exhausting ascents, and partly because the passes are seldom more than that elevation above the valleys; whereas, in Sikkim, rises and descents of 6,000, and even 9,000 feet, are common in passing from valley to valley, sometimes in one day's march.

The swarthy races of Dingcham have been elsewhere described; they are an honest, hospitable, and very hardy people, differing from the northern Tibetans chiefly in colour, and in invariably wearing the pigtail, which M.M. Huc and Gabet assure us is not usual in Lhassa.[1] They are a pastoral race, and Camp-

Tibet from Donkia almost to the Yaru-Tsampu river would be everywhere intersected by glaciers and other impassable barriers of snow and ice, for a breadth of fifty miles, and the country would have no parallel for amount of snow beyond the Polar circles. It is impossible to conjecture what would have been the effects on the climate of northern India and central Asia under these conditions. When, however, we reflect upon the evidences of glacial phenomena that abound in all the Himalayan valleys at and above 9,000 feet elevation, it is difficult to avoid the conclusion that such a state of things once existed, and at a comparatively very recent period.

[1] Amongst Lhassan customs alluded to by these travellers, is that of the women smearing their faces with a black pigment, the object of which they affirm to be that they may render themselves odious to the male sex, and thus

bell saw a flock of 400 hornless sheep, grazing on short sedges (*Carex*) and fescue-grass, in the middle of October, at 18,000 feet above the sea. An enormous ram attended the flock, whose long hair hung down to the ground; its back was painted red.

There is neither tree nor shrub in this country; and a very little wheat (which seldom ripens), barley, turnips, and radishes are, I believe, the only crops, except occasionally peas. Other legumes, cabbages, &c., are cultivated in the sheltered valleys of the Yaru feeders, where great heat is reflected from the rocks; and there also stunted trees grow, as willows, walnuts, poplars, and perhaps ashes; all of which, however, are said to be planted and scarce. Even at Teshoo Loombo and Jigatzi[1] buckwheat is a rare crop, and only a prostrate very hardy kind is grown. Clay teapots and pipkins are the most valuable exports to Sikkim from the latter city, after salt and soda. Jewels and woollen cloaks are also exported, the latter especially from Giantchi. which is famous for its woollen fabrics and mart of ponies.

Of the Yaru river at Jigatzi, which all affirm becomes the Burrampooter in Assam, I have little information to add to Turner's description: it is sixty miles north of Bhomtso, and I

avoid temptation. The custom is common enough, but the real object is to preserve the skin, which the dry cold wind peels from the face. The pigment is mutton-fat, blackened, according to Tchebu Lama, with catechu and other ingredients; but I believe more frequently by the dirt of the face itself. I fear I do not slander the Tibetan damsels in saying that personal cleanliness and chastity are both lightly esteemed amongst them; and as the Lama naïvely remarked, when questioned on the subject, "the Tibetan women are not so different from women of other countries as to wish to conceal what charms they possess."

[1] Digarchi, Jigatzi, or Shigatzi jong (the fort of Shigatzi is the capital of the "Tsang" province, and Teshoo Loombo is the neighbouring city of temples and monasteries, the ecclesiastical capital of Tibet, and the abode of the grand (Teshoo) Lama, or ever-living Boodh. Whether we estimate this man by the number of his devotees, or the perfect sincerity of their worship, he is without exception one of the most honoured beings living in the world. I have assumed the elevation of Jigatzi to be 13—14,000 feet, using as data Turner's October mean temperature of Teshoo Loombo, and the decrement for elevation of 400 feet to 1° Fahr. which my own observations indicate as an approximation to the truth. Humboldt ("Asie Centraile," iii., p. 223) uses a much smaller multiplier, and infers the elevation of Teshoo Loombo to be between 9,500 and 10,000 feet. Our data are far too imperfect to warrant any satisfactory conclusions on this interesting subject; but the accounts I have received of the vegetation of the Yaru valley at Jigatzi seem to indicate an elevation of at least 13,000 feet for the bed of that river. Of the elevation of Lhassa itself we have no idea: if MM. Huc and Gabet's statement of the rivers not being frozen there in March be correct, the climate must be very different from what it is generally supposed to be.

assume its elevation to be 13—14,000 feet[1] it takes an immense bend to the northward after passing Jigatzi, and again turns south, flowing to the west of Lhassa, and at some distance from that capital. Lhassa, as all agree, is at a much lower elevation than Jigatzi; and apricots (whose ripe stones Dr. Campbell procured for me) and walnuts are said to ripen there, and the Dama or Himalayan furze (*Caragana*), is said to grow there. The Bactrian camel also thrives and breeds at Lhassa, together with a small variety of cow (not the yak), both signs of a much more temperate climate than Jigatzi enjoys. It is, however, a remarkable fact that there are two tame elephants near the latter city, kept by the Teshoo Lama. They were taken to Jigatzi, through Bhotan, by Phari; and I have been informed that they have become clothed with long hair, owing to the cold of the climate; but Tchebu Lama contradicted this, adding, that his countrymen were so credulous, that they would believe blankets grew on the elephants' backs, if the Lamas told them so.

No village or house is seen throughout the extensive area over which the eye roams from Bhomtso, and the general character of the desolate landscape was similar to that which I have described as seen from Donkia Pass (p. 377). The wild ass[2] grazing with

[1] The Yaru, which approaches the Nepal frontier west of Tingri, and beyond the great mountain described at vol. i. p. 265, makes a sweep to the northward, and turns south to Jigatzi, whence it makes another and greater bend to the north, and again turning south flows west of Lhassa, receiving the Kechoo river from that holy city. From Jigatzi it is said to be navigable to near Lhassa by skin and plank-built boats. Thence it flows south-east to the Assam frontier, and while still in Tibet is said to enter a warm climate, where tea, silk, cotton, and rice, are grown. Of its course after entering the Assam Himalaya little is known, and in answer to my inquiries why it had not been followed, I was always told that the country through which it flowed was inhabited by tribes of savages, who live on snakes and vermin, and are fierce and warlike. These are no doubt the Singpho, Bor and Bor-abor tribes who inhabit the mountains of Upper Assam. A travelling mendicant was once sent to follow up the Dihong to the Burrampooter, under the joint auspices of Mr. Hodgson and Major Jenkins, the Commissioner of Assam, but the poor fellow was speared on the frontier by these savages. The concurrent testimony of the Assamese, that the Dihong is the Yaru, on its southern course to become the Burrampooter, renders this point as conclusively settled as any, resting on mere oral evidence, is likely to be.

[2] This, the *Equus Hemionus* of Pallas, the untameable Kiang of Tibet, abounds in Dingcham, and we saw several. It resembles the ass more than the horse, from its size, heavy head, small limbs, thin tail, and the stripe over the shoulder. The flesh is eaten and much liked. The Kiang-lah mountains are so named from their being a great resort of this creature. It differs widely from the wild ass of Persia, Sind, and Beloochistan, but is undoubtedly the same as the Siberian animal.

its foal on the sloping downs, the hare bounding over the stony soil, the antelope scouring the sandy flats, and the fox stealing along to his burrow, are all desert and Tartarian types of the animal creation. The shrill whistle of the marmot alone breaks the silence of the scene, recalling the snows of Lapland to the mind; the kite and raven wheel through the air, 1,000 feet overhead, with as strong and steady a pinion as if that atmosphere possessed the same power of resistance that it does at the level of the sea. Still higher in the heavens, black long V-shaped trains of wild geese cleave the air, shooting over the glacier-crowned top of Kinchinjhow, and winging their flight in one day, perhaps from the Yaru to the Ganges, over 500 miles of space, and through 22,000 feet of elevation. One plant alone, the yellow lichen (*Borrera*), is found at this height, and only as a visitor; for, Tartar-like, it emigrates over these lofty slopes and ridges, blown about by the violent winds. I found a small beetle on the very top,[1] probably blown up also, for it was a flower-feeder, and seemed benumbed with cold.

Every night that we spent in Tibet, we enjoyed a magnificent display of sunbeams converging to the east, and making a false sunset. I detailed this phenomenon when seen from the Kymore mountains, and I repeatedly saw it again in the Khasia, but never in the Sikkim Himalaya, whence I assume that it is most frequent in mountain plateaus. As the sun set, broad purple beams rose from a dark, low leaden, bank on the eastern horizon, and spreading up to the zenith, covered the intervening space: they lasted through the twilight, from fifteen to twenty minutes, fading gradually into the blackness of night. I looked in vain for the beautiful lancet beam of the zodiacal light; its position was obscured by Chomiomo.

On the 18th of October we had another brilliant morning, after a cold night, the temperature having fallen to 4°. I took the altitude of Yeumtso by carefully boiling two thermometers, and the result was 16,279 feet, the barometrical observations giving 16,808 feet. I removed a thermometer sunk three feet in the gravelly soil, which showed a temperature of 43°,[2] which is 12° 7 above the mean temperature of the two days we camped here.

Our fires were made of dry yak droppings, which soon burn

[1] I observed a small red *Acarus* (mite) at this elevation, both on Donkia and Kinchinjhow, which reminds me that I found a species of the same genus at Cockburn Island (in latitude 64° south, longtitude 64° 49 west). This genus hence inhabits a higher southern latitude than any other land animal attains.

[2] It had risen to 43° 5 during the previous day.

out with a fierce flame, and much black smoke; they give a disagreeable taste to whatever is cooked with them.

Having sent the coolies forward to Cholamoo lake, we re-ascended Bhomtso to verify my observations. As on the previous occasion a violent dry north-west wind blew, peeling the skin from our faces, loading the hair with grains of sand, and rendering theodolite observations very uncertain; besides injuring all my instruments, and exposing them to great risk of breakage.

The Tibetan Sepoys did not at all understand our ascending Bhomtso a second time; they ran after Campbell, who was ahead on a stout pony, girding up their long garments, bracing their matchlocks tight over their shoulders, and gasping for breath at every step, the long horns of their muskets bobbing up and down as they toiled amongst the rocks. When I reached the top I found Campbell seated behind a little stone wall which he had raised to keep off the violent wind, and the uncouth warriors in a circle round him, puzzled beyond measure at his admiration of the view. My instruments perplexed them extremely, and in crowding round me they broke my azimuth compass. They left us to ourselves when the fire I made to boil the thermometers went out, the wind being intensely cold. I had given my barometer to one of Campbell's men to carry, who not coming up, the latter kindly went to search for him, and found him on the ground quite knocked up and stupified by the cold, and there, if left alone, he would have lain till overtaken by death.

The barometer on the summit of Bhomtso stood at 15·548 inches;[1] the temperature between 11·30 A.M. and 2·30 P.M. fluctuated between 44° and 56°: this was very high for so great an elevation, and no doubt due to the power of the sun on the sterile soil, and consequent radiated heat. The tension of vapour was ·0763, and the dew-point was 5° 8, or 43° 5 below the temperature of the air. Such extraordinary dryness[2] and consequent evaporation, increased by the violent wind, sufficiently accounts for the height of the snow line; in further evidence of which, I may add that, a piece of ice or snow laid on the ground here, does not melt, but disappears by evaporation.

The difference between the dry cold air of this elevation and

[1] The elevation of Bhomtso, worked by Bessel's tables, and using corrected observations of the Calcutta barometer for the lower station, is 18,590 feet. The corresponding dew-point 4° 4 (49° 6 below that of the air at the time of observation). By Oltmann's tables the elevation is 18,540 feet. The elevation by boiling water is 18,305.

[2] The weight of vapour in a cubic foot of air was no more than $\frac{2}{1000}$ of a grain, and the saturation point ·208.

that of the heated plains of India is very great. During the driest winds of the Terai, in spring, the temperature is 80° to 90°, the tension of vapour is ·400 to ·500, with a dew-point 22° below the temperature, and upwards of six grains of vapour are suspended in the cubic foot of air; a thick haze obscures the heavens, and clouds of dust rise high in the air; here on the other hand (probably owing to the rarity of the atmosphere and the low tension of its vapours), the drought is accompanied by perfect transparency, and the atmosphere is too attenuated to support the dust raised by the wind.

We descended in the afternoon, and on our way up the Lachen valley examined a narrow gully in a lofty red spur from Kinchinjhow, where black shales were *in situ*, striking north-east, and dipping north-west 45°. These shales were interposed between beds of yellow quartz conglomerate, upon the latter of which rested a talus of earthy rocks, angular fragments of which were strewed about opposite this spur, but were not seen elsewhere.

It became dark before we reached the Cholamoo lake, where we lost our way amongst glaciers, moraines, and marshes. We expected to have seen the lights of the camp, but were disappointed, and as it was freezing hard, we began to be anxious, and shouted till the echoes of our voices against the opposite bank were heard by Tchebu Lama, who met us in great alarm for our safety. Our camp was pitched some way from the shore, on a broad plain, 16,900 feet above the sea.[1] A cold wind descended from Donkia; yet, though more elevated than Yeumtso, the climate of Cholamoo, from being damper and misty, was milder. The minimum thermometer fell to 14°.

Before starting for Donkia pass on the following morning, we visited some black rocks which rose from the flat to the east of the lake. They proved to be of fossiliferous limestone, the strata of which were much disturbed: the strike appeared in one part north-west, and the dip north-east 45°: a large fault passed east by north through the cliff, and it was further cleft by joints running northwards. The cliff was not 100 yards long, and was about 70 thick; its surface was shivered by frost into cubical masses, and glacial boulders of gneiss lay on the top. The lime-

[1] This, which is about the level of the lake, gives the Lachen river a fall of about 1,500 feet between its source and Kongra Lama, or sixty feet per mile following its windings. From Kongra Lama to Tallum it is 140 feet per mile; from Tallum to Singtam 160 feet; and from Singtam to the plains of India 50 feet per mile. The total fall from Cholamoo lake to its exit on the plains of India is eighty-five feet per mile. Its length, following its windings, is 195 miles, upwards of double the direct distance.

stone rock was chiefly a blue pisolite conglomerate, with veins and crystals of white carbonate of lime, seams of shale, and iron pyrites. A part was compact and blue, very crystalline, and full of encrinitic fossils, and probably nummulites, but all were too much altered for determination.

This, from its mineral characters, appears to be the same limestone formation which occurs throughout the Himalaya and Western Tibet; but the fossils I collected are in too imperfect a state to warrant any conclusions on this subject. Its occurrence immediately to the northward of the snowy mountains, and in such very small quantities, are very remarkable facts. The neighbouring rocks of Donkia were gneiss with granite veins, also striking north-west and dipping north-east 10°, as if they overlay the limestone, but here as in all similar situations there was great confusion of the strata, and variation in direction and strike.

And here I may once for all confess that though I believe the general strike of the rocks on this frontier to be north-west, and the dip north-east, I am unable to affirm it positively; for though I took every opportunity of studying the subject, and devoted many hours to the careful measuring and recording of dips and strikes, on both faces of Kinchinjhow, Donkia, Bhomtso, and Kongra Lama, I am unable to reduce these to any intelligible system.[1]

The coolies of Dr. Campbell's party were completely knocked up by the rarified air; they had taken a whole day to march here from Yeumtso, scarcely six miles, and could eat no food at night. A Lama of our party offered up prayers [2] to Kinchinjhow for the recovery of a stout Lepcha lad (called Nurko), who showed no signs of animation, and had all the symptoms of serous apoplexy. The Lama perched a saddle on a stone, and burning incense before it, scattered rice to the winds, invoking Kinchin, Donkia, and all the neighbouring peaks. A strong dose of calomel and jalap, which we poured down the sick lad's throat, contributed materially to the success of these incantations.

[1] North-west is the prevalent strike in Kumaon, the north-west Himalaya generally, and throughout Western Tibet, Kashmir, &c., according to Dr. Thomson.

[2] All diseases are attributed by the Tibetans to the four elements, who are propitiated accordingly in cases of severe illness. The winds are invoked in cases of affections of the breathing; fire in fevers and inflammations; water in dropsy, and diseases whereby the fluids are affected; and the God of earth when solid organs are diseased, as in liver-complaints, rheumatism, &c. Propitiatory offerings are made to the deities of these elements, but never sacrifices.

The Tibetan Sepoys were getting tired of our delays, which so much favoured my operations; but though showing signs of impatience and sulkiness, they behaved well to the last; taking the sick man to the top of the pass on their yaks, and assisting all the party: nothing, however, would induce them to cross into Sikkim, which they considered as "Company's territory."

Before proceeding to the pass, I turned off to the east, and reascended Donkia to upwards of 19,000 feet, vainly hoping to get a more distant view, and other bearings of the Tibetan mountains. The ascent was over enormous piles of loose rocks split by the frost, and was extremely fatiguing. I reached a peak overhanging a steep precipice, at whose base were small lakes and glaciers, from which flowed several sources of the Lachen, afterwards swelled by the great affluent from Cholamoo lake. A few rocks striking north-east and dipping north-west, projected at the very summit, with frozen snow amongst them, beyond which the ice and precipices rendered it impossible to proceed: but though exposed to the north, there was no perpetual snow in the ordinary acceptation of the term, and an arctic European lichen (*Lecidea oreina*) grew on the top, so faintly discolouring the rocks as hardly to be detected without a magnifying-glass.

I descended obliquely, down a very steep slope of 35°, over upwards of a thousand feet of débris, the blocks on which were so loosely poised on one another, that it was necessary to proceed with the utmost circumspection, for I was alone, and a false step would almost certainly have been followed by breaking a leg. The alternate freezing and thawing of rain amongst these masses, must produce a constant downward motion in the whole pile of débris (which was upwards of 2,000 feet high), and may account for the otherwise unexplained phenomenon of continuous shoots of angular rocks reposing on very gentle slopes in other places.[1]

The north ascent to the Donkia pass is by a path well selected amongst immense angular masses of rock, and over vast piles of débris: the strike on this, the north face, was again north-east, and dip north-west. I arrived at the top at 3 P.M., thoroughly fatigued, and found my faithful Lepcha lads (Cheytoong and

[1] May not the origin of the streams of quartz blocks that fill gently sloping broad valleys several miles long, in the Falkland Islands, be thus explained? (See "Darwin's Journal," in Murray's Home and Col. Lib.) The extraordinary shifting in the position of my thermometer left among the rocks of the Donkia pass (see p. 380), and the mobile state of the slopes I descended on this occasion, first suggested this explanation to me. When in the Falkland Islands I was wholly unable to offer any explanation of the phenomenon there, to which my attention had been drawn by Mr. Darwin's narrative.

Bassebo) nestling under a rock with my theodolite and barometers, having been awaiting my arrival in the biting wind for three hours. My pony stood there too, the picture of patience, and laden with minerals. After repeating my observations, I proceeded to Momay Samdong, where I arrived after dusk. I left a small bottle of brandy and some biscuits with the lads, and it was well I did so, for the pony knocked up before reaching Momay, and rather than leave my bag of stones, they passed the night by the warm flank of the beast, under a rock at 18,000 feet elevation, without other food, fire, or shelter.

I found my companion encamped at Momay, on the spot I had occupied in September; he had had the utmost difficulty in getting his coolies on, as they threw down their light loads in despair, and lying with their faces to the ground, had to be roused from a lethargy that would soon have been followed by death.

We rested for a day at Momay, and on the 20th, attempted to ascend to the Donkia glacier, but were driven back by a heavy snow-storm. The scenery, on arriving here, presented a wide difference to that we had left; snow lying at 16,500 feet, whereas immediately to the north of the same mountain there was none at 19,000 feet. Before leaving Momay, I sealed two small glass flasks containing the air of this elevation, by closing with a spirit lamp a very fine capillary tube, which formed the opening to each; avoiding the possibility of heating the contents by the hand or otherwise. The result of its analysis by Mr. Muller (who sent me the prepared flasks), was that it contained 36·538 per cent in volume of oxygen; whereas his repeated analysis of the air of Calcutta gives 21 per cent. Such a result is too anomalous to be considered satisfactory.

I again visited the Kinchinjhow glacier and hot springs; the water had exactly the same temperature as in the previous month, though the mean temperature of the air was 8° or 9° lower. The minimum thermometer fell to 22°, being ten lower than it ever fell in September.

We descended to Yeumtong in a cold drizzle, arriving by sunset; we remained through the following day, hoping to explore the lower glacier on the opposite side of the valley: which, however, the weather entirely prevented. I have before mentioned (p. 392) that in descending in autumn from the drier and more sunny rearward Sikkim valleys, the vegetation is found to be most backward in the lowest and dampest regions. On this occasion, I found asters, grasses, polygonums, and other plants that were withered, brown, and seeding at Momay (14,000

to 15,000 feet), at Yeumtong (12,000 feet) green and unripe; and 2,000 feet lower still, at Lachoong, the contrast was even more marked. Thus the short backward spring and summer of the Arctic zone is overtaken by an early and forward seed-time and winter: so far as regards the effects of mean temperature, the warmer station is in autumn more backward than the colder. This is everywhere obvious in the prevalent plants of each, and is especially recognisable in the rhododendrons; as the following table shows:—

16,000 to 17,000 feet, *R. nivale* flowers in July; fruits in September = 2 months.
13,000 ,, 14,000 feet, *R. anthopogon* flowers in June; fruits in Oct. = 4 months.
11,000 ,, 12,000 feet, *R. campanulatum* flowers in May; fruits in Nov = 6 months.
8,000 ,, 9,000 feet, *R. argenteum* flowers in April; fruits in Dec. = 8 months.

And so it is with many species of *Compositæ* and *Umbelliferæ*, and indeed of all natural orders, some of which I have on the same day gathered in ripe fruit at 13,000 to 14,000 feet, and found still in flower at 9,000 to 10,000 feet. The brighter skies and more powerful and frequent solar radiation at the greater elevations account for this apparent inversion of the order of nature.[1]

I was disappointed at finding the rhododendron seeds still immature at Yeumtong, for I was doubtful whether the same kinds might be met with at the Chola pass, which I had yet to visit; besides which, their tardy maturation threatened to delay me for an indefinite period in the country. *Viburnum* and

[1] The distribution of the seasons at different elevations in the Himalaya gives rise to some anomalies that have puzzled naturalists. From the middle of October to that of May, vegetation is torpid above 14,000 feet, and indeed almost uniformly covered with snow. From November to the middle of April, vegetation is also torpid above 10,000 feet, except that a few trees and bushes do not ripen all their seeds till December. The three winter months (December, January, and February) are all but dead above 6,000 feet, the earliest appearance of spring at Darjeeling (7,000 feet) being at the sudden accession of heat in March. From May till August the vegetation at each elevation is (in ascending order) a month behind that below it; 4,000 feet being about equal to a month of summer weather in one sense. I mean by this, that the genera and natural orders (and sometimes the species) which flower at 8,000 feet in May, are not so forward at 12,000 feet till June, nor at 16,000 feet till July. After August, however, the reverse holds good; then the vegetation is as forward at 16,000 feet as at 8,000 feet. By the end of September most of the natural orders and genera have ripened their fruit in the upper zone, though they have flowered as late as July: whereas October is the fruiting month at 12,000, and November below 10,000 feet. Dr. Thomson does not consider that the more sunny climate of the loftier elevations sufficiently accounts for this, and adds the stimulus of cold, which must act by checking the vegetative organs and hastening maturation.

Lonicera, however, were ripe and abundant; the fruits of both are considered poisonous in Europe, but here the black berries of a species of the former (called "Nalum") are eatable and agreeable; as are those of a *Gualtheria*, which are pale blue, and called "Kalumbo." Except these, and the cherry mentioned above, there are no other autumnal fruits above 10,000 feet: brambles, strange as it may appear, do not ascend beyond that elevation in the Sikkim Himalaya, though so abundant below it, both in species and individuals, and though so typical of northern Europe.

At Lachoong we found all the yaks that had been grazing till the end of September at the higher elevations, and the Phipun presented our men with one of a gigantic size, and proportionally old and tough. The Lepchas barbarously slaughtered it with arrows, and feasted on the flesh and entrails, singed and fried the skin, and made soup of the bones, leaving nothing but the horns hoofs. Having a fine day, they prepared some as jerked meat, cutting it into thin strips, which they dried on the rocks. This (called "Schat-chew," dried meat) is a very common and favourite food in Tibet, I found it palatable: but on the other hand, the dried saddles of mutton, of which they boast so much, taste so strongly of tallow, that I found it impossible to swallow a morsel of them.[1]

We stayed two days at Lachoong, two of my lads being again laid up with fever; one of them had been similarly attacked at the same place nearly two months before: the other lad had been

[1] Raw dried split fish are abundantly cured (without salt) in Tibet; they are caught in the Yaru and great lakes of Ramchoo, Dobtah, and Yarbru, and are chiefly carp, and allied fish, which attain a large size. It is one of the most remarkable facts in the zoology of Asia, that no trout or salmon inhabits any of the rivers that débouche into the Indian Ocean (the so-called Himalayan trout is a species of carp). This widely distributed natural order of fish (*Salmonidæ*) is, however, found in the Oxus, and in all the rivers of central Asia that flow north and west, and the *Salmo orientalis*, M'Clelland ("Calcutta Journ. Nat. Hist." iii., p. 283), was caught by Mr. Griffith (Journals, p. 404) in the Bamean river (north of the Hindo Koosh) which flows into the Oxus, and whose waters are separated by one narrow mountain ridge from those of the feeders of the Indus. The central Himalayan rivers often rise in Tibet from lakes full of fish, but have none (at least during the rains) in that rapid part of their course from 10,000 to 14,000 feet elevation: below that fish abound, but I believe invariably of different species from those found at the sources of the same rivers. The nature of the tropical ocean into which all the Himalayan rivers débouche, is no doubt the proximate cause of the absence of *Salmonidæ*. Sir John Richardson (Fishes of China Seas, &c., "in Brit. Ass. Rep. &c."), says that no species of the order has been found in the Chinese or eastern Asiatic seas.

repeatedly ill since June, and at all elevations. Both cases were returns of a fever caught in the low unhealthy valleys some months previously, and excited by exposure and hardship.

The vegetation at Lachoong was still beautiful, and the weather mild, though snow had descended to 14,000 feet on Tunkra. *Compositæ* were abundantly in flower, apples in young fruit, bushes of *Cotoneaster* covered with scarlet berries, and the brushwood silvery with the feathery heads of *Clematis*.

I here found that I had lost a thermometer for high temperatures, owing to a hole in the bag in which Cheytoong carried those of my instruments which were in constant use. It had been last used at the hot springs of the Kinchinjhow glacier; and the poor lad was so concerned at his mishap, that he came to me soon afterwards, with his blanket on his back, and a few handfuls of rice in a bag, to make his salaam before setting out to search for it. There was not now a single inhabitant between Lachoong and that dreary spot, and strongly against my wish he started, without a companion. Three days afterwards he overtook us at Keadom, radiant with joy at having found the instrument: he had gone up to the hot springs, and vainly sought around them that evening; then rather than lose the chance of a day-light search on his way back, he had spent the cold October night *in the hot water*, without fire or shelter, at 16,000 feet above the sea. Next morning his search was again fruitless; and he was returning disconsolate, when he descried the brass case glistening between two planks of the bridge crossing the river at Momay, over which torrent the instrument was suspended. The Lepchas have generally been considered timorous of evil spirits, and especially averse to travelling at night, even in company. However little this gallant lad may have been given to superstition, he was nevertheless a Lepcha, born in a warm region, and had never faced the cold till he became my servant; and it required a stout heart and an honest one, to spend a night in so awful a solitude as that which reigns around the foot of the Kinchinjhow glacier.[1]

The villagers at Keadom, where we slept on the 26th, were busy cutting the crops of millet, maize, and *Amaranthus*. A girl who, on my way down the previous month, had observed my

[1] The fondness of natives for hot springs wherever they occur is very natural, and has been noticed by Humboldt, "Pers. Narr." iv. 195, who states that on Christianity being introduced into Iceland, the natives refused to be baptised in any but the water of the Geysers. I have mentioned at p. 371 the uses to which the Yeumtong hot springs are put; and the custom of using artificial hot baths is noticed at p. 214.

curiosity about a singular variety of the maize, had preserved the heads on their ripening, and now brought them to me. The peaches were all gathered, and though only half ripe, were better than Darjeeling produce. A magnificent tree of *Bucklandia*, one of the most beautiful evergreens in Sikkim, grew near this village; it had a trunk twenty-one feet seven inches in girth, at five feet from the ground, and was unbranched for forty feet.[1] Ferns and the beautiful air-plant *Cœlogyne Wallichii* grew on its branches, with other orchids, while *Clematis* and *Stauntonia* climbed the trunk. Such great names (Buckland, Staunton, and Wallich) thus brought before the traveller's notice, never failed to excite lively and pleasing emotions: it is the ignorant and unfeeling alone who can ridicule the association of the names of travellers and naturalists with those of animals and plants.

We arrived at Choongtam (for the fourth time) at noon, and took up our quarters in a good house near the temple. The autumn and winter flowering plants now prevailed here, such as *Labiatæ*, which are generally late at this elevation; and grasses, which, though rare in the damp forest regions, are so common on these slopes that I here gathered twenty-six kinds. I spent a day here in order to collect seeds of the superb rhododendrons[2] which I had discovered in May, growing on the hills behind. The ascent was now difficult, from the length of the wiry grass, which rendered the slopes so slippery that it was impossible to ascend without holding on by the tussocks.

A ragged Tibetan mendicant (Phud) was amusing the people: he put on a black mask with cowris shells for eyes, and danced uncouth figures with a kind of heel and toe shuffle, in excellent time, to rude Tibetan songs of his own: for this he received ample alms, which a little boy collected in a wallet. These vagrants live well upon charity; they bless, curse, and transact

[1] This superb tree is a great desideratum in our gardens; I believe it would thrive in the warm west of England. Its wood is brown, and not valuable as timber, but the thick, bright, glossy, evergreen foliage is particularly handsome, and so is the form of the crown. It is also interesting in a physiological point of view, from the woody fibre being studded with those curious microscopic discs so characteristic of pines, and which when occurring on fossil wood are considered conclusive as to the natural family to which such woods belong. Geologists should bear in mind that not only does the whole natural order to which *Bucklandia* belongs, possess this character, but also various species of *Magnoliaceæ* found in India, Australia, Borneo, and South America.

[2] These Rhododendrons are now all flourishing at Kew and elsewhere: they are *R. Dalhousiæ*, *arboreum*, *Maddeni*, *Edgeworthii*, *Aucklandii* and *virgatum*.

little affairs of all kinds up and down the valleys of Sikkim and Tibet; this one dealt in red clay teapots, sheep and puppies.

We found Meepo at Choongtam: I had given him leave (when here last) to go back to the Rajah, and to visit his wife; and he had returned with instructions to conduct me to the Chola and Yakla passes in Eastern Sikkim. These passes, like that of

TIBETAN PHUD.

Tunkra (p. 366), lead over the Chola range to that part of Tibet which is interposed between Sikkim and Bhotan. My road lay past the Rajah's residence, which we considered very fortunate, as apparently affording Campbell an opportunity of a conference with his highness, for which both he and the Tchebu Lama were most anxious.

On the way down the Lachen-Lachoong, we found the valley still flooded (as described at p. 20 and 146), and the alders standing with their trunks twelve feet under water; but the shingle dam was now dry and hard: it would probably soften, and be carried away by the first rains of the following year. I left here the temperate flora of northern Sikkim, tropical forms commencing to appear: of these the nettle tribe were most numerous in the woods. A large grape, with beautiful clusters of round purple berries, was very fair eating; it is not the common vine of Europe, which nevertheless is probably an Himalayan plant, the *Vitis Indica*.[1]

At Chakoong the temperature of the river, which in May was 54°, was now 51° 5 at 3 P.M. We did not halt here, but proceeded to Namgah, a very long and fatiguing march. Thence a short march took us to Singtam, which we reached on the 30th of October. The road by which I had come up was for half the distance obliterated in most parts by landslips,[2] but they were hard and dry, and the leeches were gone.

Bad weather, and Campbell's correspondence with the Durbar, who prevented all communication with the Rajah, detained us here two days, after which we crossed to the Teesta valley, and continued along its east bank to Tucheam, 2,000 feet above the river. We obtained a magnificent view of the east face of Kinchinjunga, its tops bearing respectively N. 62° W., and N. 63° W.: the south slope of the snowed portion in profile was 34°, and of the north 40°; but both appeared much steeper to the eye, when unaided by an instrument.

The great shrubby nettle (*Urtica crenulata*) is common here: this plant, called "Mealum-ma," attains fifteen feet in height; it has broad glossy leaves, and though apparently without stings, is held in so great dread,[3] that I had difficulty in getting help to cut

[1] The origin of the common grape being unknown, it becomes a curious question to decide whether the Himalayan *Vitis Indica* is the wild state of that plant: an hypothesis strengthened by the fact of Bacchus, &c., having come from the East.

[2] I took a number of dips and strikes of the micaceous rocks: the strike of these was as often north-east as north-west; it was ever varying, and the strata were so disturbed, as materially to increase the number and vast dimensions of the landslips.

[3] The stinging hairs are microscopic, and confined to the young shoots, leaf and flower-stalks. Leschenault de la Tour describes being stung by this nettle on three fingers of his hand only at the Calcutta Botanical Gardens, and the subsequent sneezing and running at the nose, followed by tetanic symptoms and two days' suffering, nor did the effects disappear for nine days. It is a remarkable fact that the plant stings violently only at this season. I frequently

it down. I gathered many specimens without allowing any part to touch my skin; still the scentless effluvium was so powerful, that mucous matter poured from my eyes and nose all the rest of the afternoon, in such abundance, that I had to hold my head over a basin for an hour. The sting is very virulent, producing inflammation; and to punish a child with "Mealum-ma" is the severest Lepcha threat. Violent fevers and death have been said to ensue from its sting; but this I very much doubt.

gathered it with impunity on subsequent occasions, and suspected some inaccuracy in my observations; but in Silhet both Dr. Thomson and I experienced the same effects in autumn. Endlicher ("Lindley's Vegetable Kingdom") attributes the causticity of nettle-juice to bicarbonate of ammonia, which Dr. Thomson and I ascertained was certainly not present in this species.

TIBETAN IMPLEMENTS.

TEA-POT, CUP, AND BRICK OF TEA; KNIFE, TOBACCO-PIPE (ACROSS CHOPSTICKS), POUCH, AND FLINT-AND-STEEL.

CHAPTER XXV

Journey to the Rajah's residence at Tumloong—Ryott valley—Rajah's house—Tupgain Lama—Lagong nunnery—Phadong Goompa—Phenzong ditto—Lepcha Sepoys—Proceedings at Tumloong—Refused admittance to Rajah—Women's dresses—Meepo's and Tchebu Lama's families—Chapel—Leave for Chola pass—Ryott river—Rungpo, view from—Deputation of Kajees, &c.—Conference—Laghep—Eatable fruit of *Decaisnea—Cathcartia*—Rhododendrons—Phieunggoong—Pines—Rutto river—Barfonchen—Curling of rhododendron leaf—Woodcock—Chola pass—Small lakes—Tibet guard and sepoys—Dingpun—Arrival of Sikkim sepoys—Their conduct—Meet Singtam Soubah—Chumanako—We are seized by the Soubah's party—Soubah's conduct—Dingpun Tinli—Treatment of Dr. Campbell—Bound and guarded—Separated from Campbell—Marched to Tumloong—Motives for such conduct—Arrive at Rungpo—At Phadong—Presents from Rajah—Visits of Lama—Of Singtam Soubah—I am cross-questioned by Amlah—Confined with Campbell—Seizure of my Coolies—Threats of attacking Darjeeling.

WE started on the 3rd of November for Tumloong (or Sikkim Durbar), Dr. Campbell sending Tchebu Lama forward with letters to announce his approach. A steep ascent, through large trees of *Rhododendron arboreum*, led over a sharp spur of mica-schist (strike north-west and dip north-east), beyond which the whole bay-like valley of the Ryott opened before us, presenting one of the most lovely and fertile landscapes in Sikkim. It is ten miles long, and three or four broad, flanked by lofty mountains, and its head girt by the beautiful snowy range of Chola, from which silvery rills descend through black pine-woods, dividing innumerable converging cultivated spurs, and uniting about 2,000 feet below us, in a profound gorge. Everywhere were scattered houses, purple crops of buckwheat, green fields of young wheat, yellow millet, broad green plantains, and orange groves.

We crossed spur after spur, often under or over precipices about fifteen hundred feet above the river, proceeding eastwards to the village of Rangang, whence we caught sight of the Rajah's house. It was an irregular low stone building of Tibetan architecture, with slanting walls and small windows high up under the broad thatched roof, above which, in the middle, was a Chinese-looking square copper-gilt canopy, with projecting eaves and bells at the corners, surmounted by a ball and square spire. On either gable of the roof was a round-topped cylinder of gilded copper, something like a closed umbrella; this is a very frequent and characteristic Boodhist ornament, and is represented in Turner's plate of the mausoleum of Teshoo Lama, ("Tibet" plate xi.); indeed the Rajah's canopy at Tumloong is probably

a copy of the upper part of the building there represented, having been built by architects from Teshoo Loombo. It was surrounded by chaits, mendongs, poles with banners, and other religious erections; and though beautifully situated on a flat terrace overlooking the valley, we were much disappointed with its size and appearance.

On the brow of the hill behind was the large red goompa of the Tupgain Lama, the late heir-apparent to the temporal and spiritual authority in Sikkim; and near it a nunnery called Lagong, the lady abbess of which is a daughter of the Rajah, who, with the assistance of sisters, keeps an enormous Mani, or praying-cylinder, revolving perpetually to the prayer of "Om Mani Padmi hom." On this side was a similar spur, on which the gilded pinnacles and copper canopy of the Phadong[1] goompa gleamed through the trees. At a considerable distance across the head of the valley was still a third goompa, that of Phenzong.

We were met by a large party of armed Lepchas, dressed in blue and white striped kirtles, broad loose scarlet jackets, and the little bamboo wattle hat lined with talc, and surmounted by a peacock's feather; they escorted us to the village, and then retired.

We encamped a few hundred feet below the Rajah's house, and close by those of Meepo and the Tchebu Lama's family, who are among the oldest and most respectable of Tibetan origin in Sikkim. The population on this, the north side of the Ryott, consists principally of Sikkim Bhoteeas and Tibetans, while the opposite is peopled by Lepchas. Crowds came to see us, and many brought presents, with which we were overwhelmed; but we could not help remarking that our cordial greetings were wholly from the older families attached to the Rajah, and from the Lamas; none proceeded from the Dewan's relatives or friends, nor therefore any in the name of the Rajah himself, or of the Sikkim government.

Tchebu Lama vainly used every endeavour to procure for us an audience with his highness; who was surrounded by his councillors, or Amlah, all of whom were adherents of the Dewan, who was in Tibet. My man Meepo, and the Tchebu Lama, who were ordered to continue in official attendance upon us, shrugged their shoulders, but could suggest no remedy. On the following morning Campbell was visited by many parties, amongst whom were the Lama's family, and that of the late Dewan (Ilam Sing),

[1] Phadong means Royal, and this temple answers to a chapel royal for the Rajah.

who implored us to send again to announce our presence, and not to dismiss at once the moonshie and his office,[1] who had accompanied us for the purpose of a conference with the Rajah. Their wishes were complied with, and we waited till noon before proceeding.

A gay and animated scene was produced by the concourse of women, dressed in their pretty striped and crossed cloaks, who

TCHEBU LAMA.

brought tokens of good-will. Amongst them Meepo's wife appeared conspicuous from the large necklaces[2] and amulets, corals, and silver filagree work, with which her neck and shoulders

[1] It is usual in India for Government officers when about to transact business, to travel with a staff (called office) of native interpreters, clerks, &c., of whom the chief is commonly called moonshie.

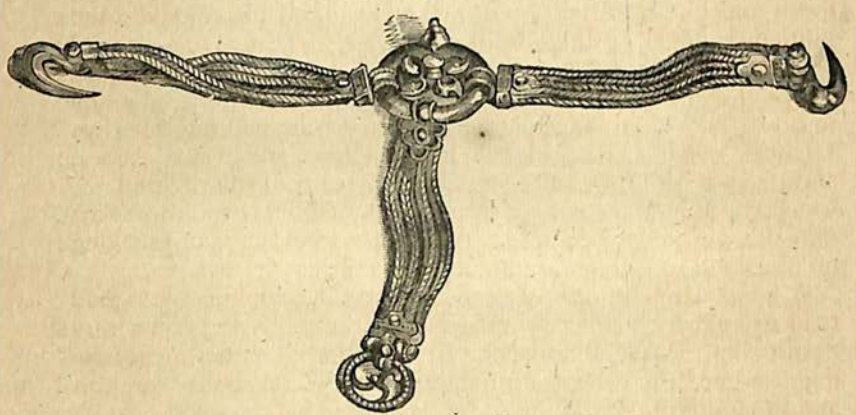
[2] The lumps of amber forming these (called "Poshea") were larger than the fist: they are procured in East Tibet, probably from Birmah.

were loaded: she wore on her head a red tiara ("Patuk") bedizened with seed pearls and large turquoises, and a gold fillet of filagree bosses united by a web of slender chains; her long tails were elaborately plaited, and woven with beads, and her cloak hooked in front by a chain of broad silver links studded with turquoises. White silk scarfs, the emblem of peace and friendship, were thrown over our hands by each party; and rice, eggs, fowls, kids, goats, and Murwa beer, poured in apace, to the great delight of our servants.

We returned two visits of ceremony, one to Meepo's house, a poor cottage, to which we carried presents of chintz dresses for his two little girls, who were busy teazing their hair with cylindrical combs, formed of a single slender joint of bamboo slit all round half-way up into innumerable teeth. Our other visit was paid to the Lama's family who inhabited a large house not far from the Rajah's. The lower story was an area enclosed by stone walls, into which the cattle, &c., were driven. An outside stone stair led to the upper story, where we were received by the head of the family, accompanied by a great concourse of Lamas. He conducted us to a beautiful little oratory at one end of the building, fitted up like a square temple, and lighted with latticed windows, covered with brilliants and tasteful paintings by Lhassan artists. The beams of the ceiling were supported by octagonal columns painted red, with broad capitals. Everywhere the lotus, the mani, and the chirki (or wheel with three rays, emblematic of the Boodhist Trinity), were introduced; "Om Mani Padmi hom" in gilt letters adorned the projecting end of every beam;[1] and the Chinese "cloud messenger," or winged dragon, floated in azure and gold along the capitals and beams, amongst scrolls and groups of flowers. At one end was a sitting figure of Gorucknath in Lama robes, surrounded by a glory, with mitre and beads; the right hand holding the Dorje, and the forefinger raised in prayer. Around was a good library of books. More presents were brought here, and tea served.

[1] A mythical animal with a dog's head and blood-red spot over the forehead was not uncommon in this chapel, and is also seen in the Sikkim temples and throughout Tibet. Ermann, in his Siberian travels, mentions it as occurring in the Khampa Lama's temple at Maimao chin; he conjectures it to have been the Cyclops of the Greeks, which according to the Homeric myth had a mark on the forehead, instead of an eye. The glory surrounding the heads of Tibetan deities is also alluded to by Ermann, who recognises in it the Nimbus of the ancients, used to protect the heads of statues from the weather, and from being soiled by birds; and adds that the glory of the ancient masters in painting was no doubt introduced into the Byzantine school from the Boodhists.

The route to Chola pass, which crosses the range of that name south of the Chola peak (17,320 feet) at the head of this valley, is across the Ryott, and then eastwards along a lofty ridge. Campbell started at noon, and I waited behind with Meepo, who wished me to see the Rajah's dwelling, to which we therefore ascended; but, to my guide's chagrin, we were met and turned back by a scribe, or clerk, of the Amlah. We were followed by a messenger, apologising and begging me to return; but I had already descended 1,000 feet, and felt no inclination to reascend the hill, especially as there did not appear to be anything worth seeing. Soon after I had overtaken Campbell, he was accosted by an excessively dirty fellow, who desired him to return for a conference with the Amlah; this was of course declined, but, at the same time,



CLASP OF A WOMAN'S CLOAK.

Campbell expressed his readiness to receive the Amlah at our halting place.

The Ryott flows in a very tropical gorge 2,000 feet above the sea; from the proximity of the snowy mountains, its temperature was only 64° 3. Thence the ascent is very steep to Rungpo, where we took up our quarters at a rest-house (alt. 6,008 feet). This road is well kept, and hence onwards is traversed yearly by the Rajah on his way to his summer residence of Choombi, two marches beyond the Chola pass; whither he is taken to avoid the Sikkim rains, which are peculiarly disagreeable to Tibetans. Runpo commands a most beautiful view northwards, across the valley, of the royal residence, temples, goompas, hamlets, and cultivation, scattered over spurs that emerge from the forest,

studded below with tree-ferns and plantains, and backed by black pine-woods and snowy mountains. In the evening the Amlah arrived to confer with Campbell; at first there was a proposal of turning us out of the house, in which there was plenty of room besides, but as we declined to move, except by his Highness's order, they put up in houses close by.

On the following morning they met us as we were departing for Chola pass, bringing large presents in the name of the Rajah, and excuses on their and his part for having paid us no respect at Tumloong, saying, that it was not the custom to receive strangers till after they had rested a day, and that they were busy preparing a suitable reception, &c.; this was all false, and contrary to etiquette, but there was no use in telling them so. Campbell spoke firmly and kindly to them, and pointed out their incivility and the unfriendly tone of their whole conduct. They then desired Campbell to wait and discuss business affairs with them; this was out of the question, and he assured them that he was ever ready to do so with the Rajah, that he was now (as he had informed his Highness) on his way with me to the Chola and Yakla passes, and that we had, for want of coolies, left some loads behind us, which, if they were really friendly, they would forward. This they did, and so we parted; they (contrary to expectation) making no objection to Campbell's proceeding with me.

A long march up a very steep, narrow ridge took us by a good road to Laghep, a stone resting-house (alt., 10,475 feet) on a very narrow flat. I had abundance of occupation in gathering rhododendron-seeds, of which I procured twenty-four kinds[1] on this and the following day.

A very remarkable plant, which I had seen in flower in the Lachen valley, called "Loodoo-ma" by the Bhoteeas, and "Nomorchi" by Lepchas, grew on the ridge at 7,000 feet; it bears a yellow fruit like short cucumbers, full of a soft, sweet, milky pulp, and large black seeds; it belongs to a new genus,[2] allied to *Stauntonia*,

[1] These occurred in the following order in ascending, commencing at 6,000 feet:—1. *R. Dalhousiæ;* 2. *R. vaccinioides;* 3. *R. camelliæflorum;* 4. *R. arboreum.* Above 8,000 feet:—5. *R. argenteum;* 6. *R. Falconeri;* 7. *R. barbatum;* 8. *R. Campbelliæ;* 9. *R. Edgeworthii;* 10. *R. niveum;* 11. *R. Thomsoni;* 12. *R. cinnabarinum;* 13. *R. glaucum.* Above 10,500 feet:—14. *R. lanatum;* 15. *R. virgatum;* 16. *R. campylocarpum;* 17. *R. ciliatum;* 18. *R. Hodgsoni;* 19. *R. campanulatum.* Above 12,000 feet:—20 *R. lepidotum;* 21. *R. fulgens;* 22. *R. Wightianum;* 23. *R. anthopogon;* 24. *R. setosum.*

[2] This genus, for which Dr. Thomson and I, in our "Flora Indica," have proposed the name *Decaisnea* (in honour of my friend Professor J. Decaisne, the eminent French botanist), has several straight, stick-like, erect branches

of which two Himalayan kinds produce similar, but less agreeable edible fruits "Kole-pot," Lepcha). At Laghep, iris was abundant, and a small bushy berberry (*B. concinna*) with oval eatable berries, The north wall of the house (which was in a very exposed spot) was quite bare, while the south was completely clothed with moss and weeds.

The rocks above Laghep were gneiss: below it, mica-schist, striking north-west, and dipping north-east, at a high angle. A beautiful yellow poppy-like plant grew in clefts at 10,000 feet; it has flowered in England, from seeds which I sent home, and bears the name of *Cathcartia*.[1]

We continued, on the following morning, in an easterly direction, up the same narrow steep ridge, to a lofty eminence called Phieung-goong (alt. 12,422 feet), from being covered with the Phieung, or small bamboo. *Abies Webbiana* begins here, and continues onwards, but, as on Tonglo, Mainom, and the other outer wetter Sikkim ranges, there is neither larch, *Pinus excelsa*, *Abes Smithiana*, or *A Brunoniana*.

Hence we followed an oblique descent of 1,500 feet, to the bed of the Rutto river, through thick woods of pines and *Rhododendron Hodgsoni*, which latter, on our again ascending, was succeeded by the various alpine kinds. We halted at Barfonchen (alt. 11,233 feet), a stone-hut in the silver-fir forest. Some yaks were grazing in the vicinity, and from their herdsman we learnt that the Dewan was at Choombi, on the road to Yakla; he had kept wholly out of the way during the summer, directing every unfriendly action to be pursued towards myself and the government by the Amlah, consisting of his brothers and relatives whom he left at Tumloong.

The night was brilliant and starlight: the minimum thermometer fell to 27°, a strong north-east wind blew down the valley, and

from the root, which bear spreading pinnated leaves, two feet long, standing out horizontally. The flowers are uni-sexual, green, and in racemes, and the fruits, of which two or three grow together, are about four inches long, and one in diameter. All the other plants of the natural order to which it belongs are climbers.

[1] See "Botanical Magazine," for 1852. The name was given in honour of the memory of my friend, the late J. F. Cathcart, Esq., of the Bengal Civil Service. This gentleman was devoted to the pursuit of botany, and caused a magnificent series of drawings of Darjeeling plants to be made by native artists during his residence there. This collection is now deposited at Kew, through the liberality of his family, and it is proposed to publish a selection from the plates, as a tribute to his memory. Mr. Cathcart, after the expiration of his Indian service, returned to Europe, and died at Lausanne on his way to England.

there was a thick hoar-frost, with which the black yaks were drolly powdered. The broad leaves of *R. Hodgsoni* were curled, from the expansion of the frozen fluid in the layer of cells on the upper surface of the leaf, which is exposed to the greatest cold of radiation. The sun restores them a little, but as winter advances, they become irrevocably curled, and droop at the ends of the branches.

We left Barfonchen on the 7th November, and ascended the river, near which we put up a woodcock. Emerging from the woods at Chumanako (alt. 12,590 feet), where there is another stone hut, the mountains become bleak, bare, and stony, and the rocks are all moutonnéed by ancient glaciers. At 13,000 feet the ground was covered with ice, and all the streams were frozen. Crossing several rocky ledges, behind which were small lakes, a gradual ascent led to the summit of the Chola pass, a broad low depression, 14,925 feet above the sea, wholly bare of snow.

Campbell had preceded me, and I found him conversing with some Tibetans, who told him that there was no road hence to Yakla, and that we should not be permitted to go to Choombi. As the Chinese guard was posted in the neighbourhood, he accompanied one of the Tibetans to see the commandant, whilst I remained taking observations. The temperature was 33°, with a violent, biting, dry east wind. The rocks were gneiss, striking north-east, and horizontal, or dipping north-west. The scanty vegetation consisted chiefly of grass and *Sibbaldia*.

In about an hour Meepo and some of my people came up and asked for Campbell, for whom the Tchebu Lama was waiting below: the Lama had remained at Rungpo, endeavouring to put matters on a better footing with the Amlah. Wishing to see the Tibet guard myself, I accompanied the two remaining Tibetans down a steep valley with cliffs on either hand, for several hundred feet, when I was overtaken by some Sikkim sepoys in red jackets, who wanted to turn me back forcibly: I was at a loss to understand their conduct, and appealed to the Tibetan sepoys, who caused them to desist. About 1,000 feet down I found Campbell, with a body of about ninety Tibetans, a few of whom were armed with matchlocks, and the rest with bows and arrows. There were commanded by a Dingpun, a short swarthy man, with a flat-crowned cap with floss-silk hanging all round, and a green glass button in front; he wore a loose scarlet jacket, broadly edged with black velvet, and having great brass buttons of the Indian naval uniform; his subaltern was similarly dressed, but his buttons were those of the 44th Bengal Infantry. The commandant having

heard of our wish to go round by Choombi, told Campbell that he had come purposely to inform him that there was no road that way to Yakla; he was very polite, ordering his party to rise and salute me when I arrived, and doing the same when we both left.

On our return we were accompanied by the Dingpun of the Tibetans and a few of his people, and were soon met by more Sikkim sepoys, who said they were sent from the Durbar, to bring Campbell back to transact business; they behaved very rudely, and when still half a mile from the Sikkim frontier, jostled him and feigned to draw their knives, and one of them pointed a spear-headed bow to his breast. Campbell defended himself with a stick, and remonstrated with them on their rudeness; and I, who had nothing but a barometer in my hand, called up the Tibetans. The Dingpun came instantly, and driving the Sikkim people forward, escorted us to the frontier, where he took an inscribed board from the chait, and showing us the great vermilion seal of the Emperor of China (or more probably of the Lhassan authorities) on one side, and two small brown ones of the Sikkim Rajah on the other; and giving us to understand that here his jurisdiction ceased, he again saluted and left us.

On descending, I was surprised to meet the Singtam Soubah, whom I had not seen since leaving Tungu; he was seated on a rock, and I remarked that he looked ashy pale and haggard, and that he salaamed to me only, and not to Campbell; and that Tchebu Lama, who was with him, seemed very uncomfortable. The Soubah wanted Campbell to stop for a conference, which at such a time, and in such a wind, was impossible, so he followed us to Chumanako, where we proposed to pass the night.

A great party of Sikkim Bhoteeas had assembled here, all strangers to me: I certainly thought the concourse unusually large, and the previous conduct to Campbell, strange, rude, and quite unintelligible, especially before the Tibetans. But the Bhoteeas were always a queer, and often insolent people,[1] whom I was long ago tired of trying to understand, and they might have wanted to show off before their neighbours; and such was the confidence with which my long travels amongst them had inspired

[1] Captain Pemberton during his mission to Bhotan was repeatedly treated with the utmost insolence by the officials in that country (see Griffith's Journal). My Sirdar, Nimbo, himself a native of Bhotan, saw a good deal of the embassy when there, and told me many particulars as to the treatment to which it had been subjected, and the consequent low estimation in which both the ambassadors themselves and the Government whom they represented were held in Bhotan.

me, that the possibility of danger or violence never entered my head.

We went into the hut, and were resting ourselves on a log at one end of it, when, the evening being very cold, the people crowded in; on which Campbell went out, saying that we had better leave the hut to them, and that he would see the tents pitched. He had scarcely left, when I heard him calling loudly to me, "Hooker! Hooker! the savages are murdering me!" I rushed to the door, and caught sight of him striking out with his fists, and struggling violently; being tall and powerful, he had already prostrated a few, but a host of men bore him down, and appeared to be trampling on him; at the same moment I was myself seized by eight men, who forced me back into the hut, and down on the log, where they held me in a sitting posture, pressing me against the wall; here I spent a few moments of agony, as I heard my friend's stifled cries grow fainter and fainter. I struggled but little, and that only at first, for at least five-and-twenty men crowded round and laid their hands upon me, rendering any effort to move useless; they were, however, neither angry nor violent, and signed to me to keep quiet. I retained my presence of mind, and felt comfort in remembering that I saw no knives used by the party who fell on Campbell, and that if their intentions had been murderous, an arrow would have been the more sure and less troublesome weapon. It was evident that the whole animus was directed against Campbell, and that though at first alarmed on my own account, all the inferences which, with the rapidity of lightning my mind involuntarily drew, were favourable.

After a few minutes, three persons came into the hut, and seated themselves opposite to me. I only recognised two of them; namely, the Singtam Soubah, pale, trembling like a leaf, and with great drops of sweat trickling from his greasy brow; and the Tchebu Lama, stolid, but evidently under restraint, and frightened. The former ordered the men to leave hold of me, and to stand guard on either side, and, in a violently agitated manner, he endeavoured to explain that Campbell was a prisoner by the orders of the Rajah, who was dissatisfied with his conduct as a government officer during the past twelve years; and that he was to be taken to the Durbar and confined till the supreme government at Calcutta should confirm such articles as he should be compelled to subscribe to; he also wanted to know from me how Campbell would be likely to behave. I refused to answer any questions till I should be informed why I was myself made

prisoner; on which he went away, leaving me still guarded. My own Sirdar then explained that Campbell had been knocked down, tied hand and foot, and taken to his tent, and that all his coolies were also bound, our captors claiming them as Sikkimites, and subjects of the Rajah.

Shortly afterwards the three returned, the Soubah looking more spectral than ever, and still more violently agitated, and I thought I perceived that whatever were his plans he had failed in them. He asked me what view the Governor-General would take of this proceeding? and receiving no answer, he went off with the Tchebu Lama, and left me with the third individual. The latter looked steadily at me for some time, and then asked if I did not know him. I said I did not, when he gave his name as Dingpun Tinli, and I recognised in him one of the men whom the Dewan had sent to conduct us to the top of Mainom the previous year (see p. 214). This opened my eyes a good deal, for he was known to be a right-hand man of the Dewan's, and had within a few months been convicted of kidnapping two Brahmin girls from Nepal,[1] and had vowed vengeance against Campbell for the duty he performed in bringing him to punishment.

I was soon asked to go to my tent, which I found pitched close by; they refused me permission to see my fellow-prisoner, or to be near him, but allowed me to hang up my instruments, and arrange my collections. My guards were frequently changed during the night, Lepchas often taking a turn; they repeatedly assured me that there was no complaint or ill-feeling against me, that the better classes in Sikkim would be greatly ashamed of the whole affair, that Tchebu Lama was equally a prisoner, and that the grievances against Campbell were of a political nature, but what they were they did not know.

The night was very cold (thermometer 26°), and two inches of snow fell. I took as many of my party as I could into my tent, they having no shelter fit for such an elevation (12,590 feet) at this season. Through the connivance of some of the people, I managed to correspond with Campbell, who afterwards gave me the following account of the treatment he had received. He stated that on leaving the hut he had been met by Meepo, who told him the Soubah had ordered his being turned out. A crowd

[1] This act, as I have mentioned at p. 239, was not only a violation of the British treaty, but an outrage on the religion of Nepal. Jung Bahadoor demanded instant restitution, which Campbell effected; thus incurring the Dingpun's wrath, who lost, besides his prize, a good deal of money which the escapade cost him.

of sepoys then fell on him and brought him to the ground, knocked him on the head, trampled on him, and pressed his neck down to his chest as he lay, as if endeavouring to break it. His feet were tied, and his arms pinioned behind, the wrist of the right hand being bound to the left arm above the elbow; the cords were then doubled, and he was violently shaken. The Singtam Soubah directed all this, which was peformed chiefly by the Dingpun Tinli and Jongpun Sangabadoo.[1] After this the Soubah came to me, as I have related; and returning, had Campbell brought bound before him, and asked him, through Tchebu Lama, if he would write from dictation. The Soubah was violent, excited, and nervous; Tchebu Lama scared. Campbell answered, that if they continued torturing him (which was done by twisting the cords round his wrist with a bamboo-wrench), he might say or do anything, but that his government would not confirm any acts thus extorted. The Soubah became still more violent, shook his bow in Campbell's face, and drawing his hand significantly across his throat, repeated his questions, adding others, inquiring why he had refused to receive the Lassoo Kajee as Vakeel, &c. (see p. 289).

The Soubah's people, meanwhile, gradually slunk away, seeing which he left Campbell, who was taken to his tent.

Early next morning Meepo was sent by the Soubah, to ask whether I would go to Yakla pass, or return to Darjeeling, and to say that the Rajah's orders had been very strict that I was not to be molested, and that I might proceed to whatever passes I wished to visit, whilst Campbell was to be taken back to the Durbar, to transact business. I was obliged to call upon the Soubah and Dingpun to explain their conduct of the previous day, which they declared arose from no ill-feeling, but simply from their fear of my interfering in Campbell's behalf; they could not see what reason I had to complain, so long as I was neither hurt nor bound. I tried in vain to explain to them that they could not so play fast and loose with a British subject, and insisted that if they really considered me free, they should place me with Campbell, under whose protection I considered myself, he being still the Governor-General's agent.

Much discussion followed this: Meepo urged me to go on to Yakla, and leave these bad people; and the Soubah and Dingpun, who had exceeded their orders in laying hands on me, both wished me away. My course was, however, clear as to the pro-

[1] This was the other man sent with us to Mainom, by the Dewan, in the previous December.

priety of keeping as close to Campbell as I was allowed, so they reluctantly agreed to take me with him to the Durbar.

Tchebu Lama came to me soon afterwards, looking as stolid as ever, but with a gulping in his throat; he alone was glad I was going with them, and implored me to counsel Campbell not to irritate the Amlah by a refusal to accede to their dictates, in which case his life might be the forfeit. As to himself, the opposite faction had now got the mastery, there was nothing for it but to succumb, and his throat would surely be cut. I endeavoured to comfort him with the assurance that they dared not hurt Campbell, and that this conduct of a party of ruffians, influenced by the Dewan and their own private pique, did not represent his Rajah's feelings and wishes, as he himself knew; but the poor fellow was utterly unnerved, and shaking hands warmly, with his eyes full of tears, he took his leave.

We were summoned by the Dingpun to march at 10 A.M.: I demanded an interview with Campbell first, which was refused; but I felt myself pretty safe, and insisting upon it, he was brought to me. He was sadly bruised about the head, arms, and wrists, walked very lame, and had a black eye to boot, but he was looking stout and confident.

I may here mention that seizing the representative of a neighbouring power and confining him till he shall have become amenable to terms, is a common practice along the Tibet, Sikkim, and Bhotan frontiers. It had been resorted to in 1847, by the Bhotanese, under the instructions of the Paro Pilo, who waylaid the Sikkim Rajah when still in Tibet, on his return from Jigatzi, and beleagured him for two months, endeavouring to bring him to their terms about some border dispute; on this occasion the Rajah applied to the British government for assistance, which was refused; and he was ultimately rescued by a Tibetan force.

In the present case the Dewan issued orders that Campbell was to be confined at Tumloong till he himself should arrive there; and the Rajah was kept in ignorance of the affair. The Sepoys who met us on our approach to Tumloong on the 3rd of November, were, I suspect, originally sent for the purpose; and I think that the Amlah also had followed us to Rungpo with the same object. Their own extreme timidity, and the general good-feeling in the country towards Campbell prevented its execution before, and, as a last resource, they selected the Singtam Soubah and Dingpun Tinli for the office, as being personally hostile to him. The Dewan meanwhile being in Tibet, and knowing that we were about to visit the frontier, for which I had full permission and

escort, sent up the Tibetan guard, hoping to embroil them in the affair; in this he failed, and it drew upon him the anger of the Lhassan authorities.[1] The Soubah, in endeavouring to extort the new treaty by force, and the Dingpun, who had his own revenge to gratify, exceeded their instructions in using violence towards Campbell, whom the Dewan ordered should be simply taken and confined; they were consequently disgraced, long before we were released, and the failure of the stratagem thrown upon their shoulders.

During the march down to Laghep, Campbell was treated by the Dingpun's men with great rudeness. I kept as near as I was allowed, quietly gathering rhododendron-seeds by the way. At the camping-ground we were again separated, at which I remonstrated with the Dingpun, also complaining of his people's insolent behaviour towards their prisoner, which he promised should be discontinued.

The next day we reached Rungpo, where we halted for further instructions: our tents were placed apart, but we managed to correspond by stealth. On the 10th of November we were conducted to Tumloong. A pony was brought for me, but I refused it, on seeing that Campbell was treated with great indignity, and obliged to follow at the tail of the mule ridden by the Dingpun, who thus marched him in triumph up to the village.

I was taken to a house at Phadong, and my fellow traveller was confined in another at some distance to the eastward, a stone's throw below the Rajah's; and thrust into a little cage-like

[1] In the following summer (1850), when the Rajah, Dewan, and Soubah repaired to Choombi, the Lhassan authorities sent a Commissioner to inquire into the affair, understanding that the Dewan had attempted to embroil the Tibetans in it. The commissioner asked the Rajah why he had committed such an outrage on the representative of the British government, under whose protection he was; thus losing his territory, and bringing English troops so near the Tibet frontier. The Rajah answered that he never did anything of the kind; that he was old and infirm, and unable to transact all his affairs; that the mischief had arisen out of the acts and ignorance of others, and finally begged the Commissioner to investigate the whole affair, and satisfy himself about it. During the inquiry that followed, the Dewan threw all the blame on the Tibetans, who, he said, were alone implicated: this assertion was easily disproved, and on the conclusion of the inquiry the Commissioner railed vehemently at the Dewan, saying:—"You tried to put this business on the people of my country; it is an abominable lie. You did it yourselves, and no one else. The Company is a great monarchy; you insulted it, and it has taken its revenge. If you, or any other Tibetan, ever again cause a rupture with the English, you shall be taken with ropes round your necks to Pekin, there to undergo the just punishment of your offence under the sentence of the mighty Emperor."

room. I was soon visited by an old Lama, who assured me that we were both perfectly safe, but that there were many grievances against Campbell. The Soubah arrived shortly after, bringing me compliments, nominally in the Rajah's name, and a substantial present, consisting of a large cow, sheep, fowls, a brick of tea, bags of rice, flour, butter, eggs, and a profusion of vegetables. I refused to take them on the friendly terms on which they were brought, and only accepted them as provisions during my detention. I remonstrated again about our separation, and warned the Soubah of the inevitable consequence of this outrage upon the representative of a friendly power, travelling under the authority of his own government, unarmed and without escort: he was greatly perplexed, and assured me that Campbell's detention was only temporary, because he had not given satisfaction to the Rajah, and as the latter could not get answers to his demands from Calcutta in less than a month, it was determined to keep him till then; but to send me to Darjeeling. He returned in the evening to tell me that Campbell's men (with the exception only of the Ghorkas[1]) had been seized, because they were runaway slaves from Sikkim; but that I need not alarm myself, for mine should be untouched.

The hut being small, and intolerably dirty, I pitched my tent close by, and lived in it for seven days: I was not guarded, but so closely watched, that I could not go out for the most trifling purpose, except under surveillance. They were evidently afraid of my escaping; I was however treated with civility, but forbidden to communicate either with Campbell or with Darjeeling.

The Soubah frequently visited me, always protesting I was no prisoner, that Campbell's seizure was a very trifling affair, and the violence employed all a mistake. He always brought presents, and tried to sound me about the government at Calcutta. On the 12th he paid his last visit, looking wofully dejected, being out of favour at court, and dismissed to his home: he referred me to Meepo for all future communications to the Rajah, and bade me a most cordial farewell, which I regretted being unable to return with any show of kind feeling. Poor fellow! he had staked his last, and lost it, when he undertook to seize the agent of the most powerful government in the east, and to reduce him to the condition of a tool of the Dewan. Despite the many obstructions he

[1] These people stood in far greater fear of the Nepalese than of the English, and the reason is obvious: the former allowed no infraction of their rights to pass unnoticed, whereas we had permitted every article of our treaty to be contravened.

had placed in my way, we had not fallen out since July; we had been constant companions, and though at issue, never at enmity. I had impeached him, and my grievances had been forwarded to the Rajah with a demand for his punishment, but he never seemed to owe me a grudge for that, knowing the Rajah's impotence as compared with the power of the Dewan whom he served; and, in common with all his party, presuming on the unwillingness of the British government to punish.

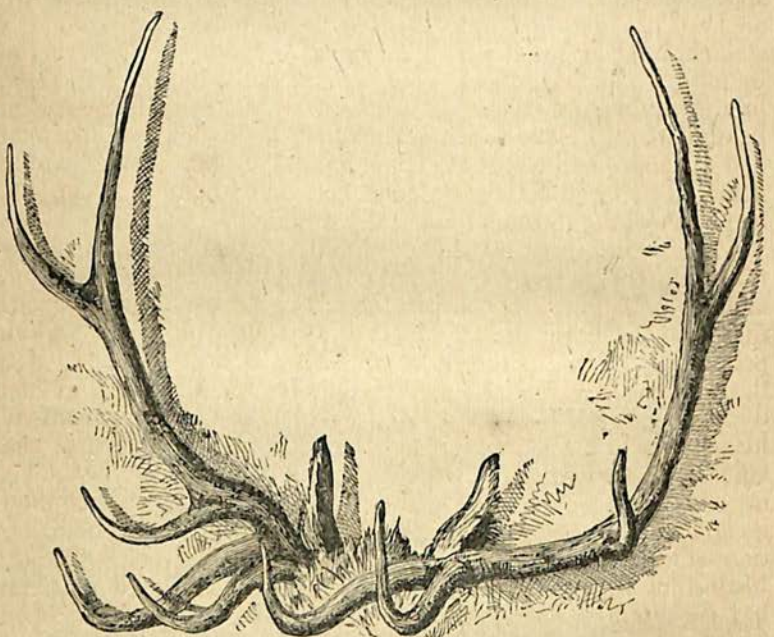
On the 13th of November I was hurriedly summoned by Meepo to the Phadong temple, where I was interrogated by the Amlah, as the Rajah's councillors (in this instance the Dewan's adherents) are called. I found four China mats placed on a stone bench, on one of which I was requested to seat myself, the others being occupied by the Dewan's elder brother, a younger brother of the Gangtok Kajee (a man of some wealth), and an old Lama: the conference took place in the open air and amongst an immense crowd of Lamas, men, women, and childrem.

I took the initiative (as I made a point of doing on all such occasions) and demanded proper interpreters, which were refused; and the Amlah began a rambling interrogatory in Tibetan, through my Lepcha Sirdar Pakshok, who spoke very little Tibetan or Hindostanee, and my half-caste servant, who spoke as little English. The Dewan's brother was very nervously counting his beads, and never raised his eyes while I kept mine steadily upon him.

He suggested most of the queries, every one of which took several minutes, as he was constantly interrupted by the Kajee, who was very fat and stupid: the Lama scarcely spoke, and the bystanders never. My connection with the Indian government was first enquired into; next they came to political matters, upon which I declined entering; but I gathered that their object was to oblige Campbell to accept the Lassoo Kajee as Vakeel, to alter the slavery laws, to draw a new boundary line with Nepal, to institute direct communication between themselves and the Governor-General,[1] and to engage that there should be no trade or communication between Sikkim and India, except through the Dewan: all of these subjects related to the terms of the original

[1] They were prompted to demand this by an unfortunate oversight that occurred at Calcutta some years before. Vakeels from the Sikkim Durbar repaired to that capital, and though unaccredited by the Governor-General's agent at Darjeeling, were (in the absence of the Governor-General) received by the president of the council in open Durbar. The effect was of course to reduce the Governor-General's agent at Darjeeling to a cipher.

treaty between the Rajah and the Indian government. They told me they had sent these proposals to the government through Darjeeling,[1] but had received no acknowledgment from the latter place, and they wanted to know the probable result at Calcutta. As the only answer I could give might irritate them, I again declined giving any. Lastly, they assured me that no blame was imputed to myself, that on the contrary I had been travelling under the Rajah's protection, who rejoiced in my success, that I might have visited Yakla pass as I had intended doing, but that



HORNS OF THE SHOWA STAG (*Cervus Wallichii*), A NATIVE OF CHOOMBI IN TIBET. Length of antler, 4 feet 6 in.

preferring to accompany my friend, they had allowed me to do so, and that I might now either join him, or continue to live in

[1] These letters, which concluded with a line stating that Campbell was detained at Tumloong till favourable answers should be received, had arrived at Darjeeling, but being written in Tibetan, and containing matters into which no one but Campbell could enter, they were laid on one side till his return. The interpreter did not read the last line, which stated that Dr. Campbell was *detained* till answers were received, and the fact of our capture and imprisonment therefore remained unknown for several weeks.

my tent: of course I joyfully accepted the former proposal. After being refused permission to send a letter to Darjeeling, except I would write in a character which they could read, I asked if they had anything more to say, and being answered in the negative, I was taken by Meepo to Campbell, heartily glad to end a parley which had lasted for an hour and a half.

I found my friend in good health and spirits, strictly guarded in a small thatched hut, of bamboo wattle and clay: the situation was pretty, and commanded a view of the Ryott valley and the snowy mountains; there were some picturesque chaits hard by, and a blacksmith's forge. Our walks were confined to a few steps in front of the hut, and included a puddle and a spring of water. We had one black room with a small window, and a fire in the middle on a stone; we slept in the narrow apartment behind it, which was the cage in which Campbell had been at first confined, and which exactly admitted us both, lying on the floor. Two or three Sepoys occupied an adjoining room, and had a peep-hole through the partition-wall.

My gratification at our being placed together was damped by the seizure of all my faithful attendants except my own servant, and one who was a Nepalese: the rest were bound, and placed in the stocks and close confinement, charged with being Sikkim people who had no authority to take service in Darjeeling. On the contrary they were all registered as British subjects, and had during my travels been recognised as such by the Rajah and all his authorities. Three times the Soubah and others had voluntarily assured me that my person and people were inviolate; nor was there any cause for this outrage but the fear of their escaping with news to Darjeeling, and possibly a feeling of irritation amongst the authorities at the failure of their schemes. Meanwhile we were not allowed to write, and we heard that the bag of letters which we had sent before our capture had been seized and burnt. Campbell greatly feared that they would threaten Darjeeling with a night attack,[1] as we heard that the

[1] Threats of sacking Darjeeling had on several previous occasions been made by the Dewan, to the too great alarm of the inhabitants, who were ignorant of the timid and pacific disposition of the Lepchas, and of the fact that there are not fifty muskets in the country, nor twenty men able to use them. On this occasion the threats were coupled with the report that we were murdered, and that the Rajah had asked for 50,000 Tibetan soldiers, who were being marched twenty-five days' journey over passes 15,000 feet high, and deep in snow, and were coming to drive the English out of Sikkim! I need hardly observe that the Tibetans (who have repeatedly refused to interfere on this side the snows) had no hand in the matter, or that, supposing they could collect that number of men in all Tibet, it would be impossible to feed them

Lassoo Kajee was stationed at Namtchi with a party for that purpose, and all communication cut off except through him.

CHAPTER XXVI.

Dr. Campbell is ordered to appear at Durbar—Lamas called to council—Threats—Scarcity of food—Arrival of Dewan—Our jailer, Thoba-sing—Temperature, &c., at Tumloong—Services of Goompas—Lepcha girl—Jew's-harp—Terror of servants—Ilam-sing's family—Interview with Dewan—Remonstrances—Dewan feigns sickness—Lord Dalhousie's letter to Rajah—Treatment of Indo-Chinese—Concourse of Lamas—Visit of Tchebu Lama—Close confinement—Dr. Campbell's illness—Conference with Amlah—Relaxation of confinement—Pemiongchi Lama's intercession—Escape of Nimbo—Presents from Rajah, Ranee and people Protestations of friendship—Mr. Lushington sent to Darjeeling—Leave Tumloong—Cordial farewell—Dewan's merchandise—Gangtok Kajee—Dewan's pomp—Governor-General's letter—Dikkeeling—Suspicion of poison—Dinner and pills—Tobacco—Bhotanese colony—Katong-ghat on Teesta—Wild lemons—Sepoys' insolence—Dewan alarmed—View of Darjeeling—Threats of a rescue—Fears of our escape—Tibet flutes—Negociate our release—Arrival at Darjeeling—Dr. Thomson joins me—Movement of troops at Darjeeling—Seizure of Rajah's Terai property.

SINCE his confinement, Dr. Campbell had been desired to attend the Durbar for the purpose of transacting business, but had refused to go, except by compulsion, considering that in the excited state of the authorities, amongst whom there was not one person of responsibility or judgment, his presence would not only be useless, but he might be exposed to further insult or possibly violence.

On the 15th of November we were informed that the Dewan was on his way from Tibet: of this we were glad, for knave as he was, we had hitherto considered him to possess sense and understanding. His agents were beginning to find out their mistake, and summoned to council the principal Lamas and Kajees of the country, who, to a man, repudiated the proceedings, and refused to attend. Our captors were extremely anxious to induce us to write letters to Darjeeling, and sent spies of all kinds to offer us facilities for secret correspondence. The simplicity and clumsiness with which these artifices were attempted would

for a week, there or in Sikkim. Such reports unfortunately spread a panic in Darjeeling: the guards were called in from all the outposts, and the ladies huddled into one house, whilst the males stood on the defensive; to the great amusement of the Amlah at Tumloong, whose insolence to us increased proportionally.

have been ludicrous under other circumstances; while the threat of murdering Campbell only alarmed us, inasmuch as it came from people too stupid to be trusted. We made out that all Sikkim people were excluded from Darjeeling, and the Amlah consequently could not conceal their anxiety to know what had befallen their letters to government.

Meanwhile we were but scantily fed, and our imprisoned coolies got nothing at all. Our guards were supplied with a handful of rice or meal as the day's allowance; they were consequently grumbling,[1] and were daily reduced in number. The supplies of rice from the Terai, beyond Darjeeling, were cut off by the interruption of communication, and the authorities evidently could not hold us long at this rate: we sent up complaints, but of course received no answer.

The Dewan arrived in the afternoon in great state, carried in an English chair given him by Campbell some years before, habited in a blue silk cloak lined with lambskin, and wearing an enormous straw hat with a red tassel, and black velvet butterflies on the flapping brim. He was accompanied by a household of women, who were laden with ornaments, and wore boots, and sat astride on ponies; many Lamas were also with him, one of whom wore a broad Chinese-like hat covered with polished copper foil. Half a dozen Sepoys with matchlocks preceded him, and on approaching Tumloong, bawled out his titles, dignities, &c., as was formerly the custom in England.

At Darjeeling our seizure was still unknown: our letters were brought to us, but we were not allowed to answer them. Now that the Dewan had arrived, we hoped to come to a speedy explanation with him; but he shammed sickness, and sent no answer to our messages, if indeed he received them. Our guards were reduced to one Sepoy with a knife, who was friendly; and a dirty, cross-eyed fellow named Thoba-sing, who, with the exception of Tchebu Lama, was the only Bhoteea about the Durbar who could speak Hindostanee, and who did it very imperfectly:

[1] The Rajah has no standing army; not even a body-guard, and these men were summoned to Tumloong before our arrival: they had no arms and received no pay, but were fed when called out on duty. There is no store for grain, no bazaar or market, in any part of the country, each family growing little enough for its own wants and no more; consequently Sikkim could not stand on the defensive for a week. The Rajah receives his supply of grain in annual contributions from the peasantry, who thus pay a rent in kind, which varies from little to nothing, according to the year, &c. He had also property of his own in the Terai, but the slender proceeds only enabled him to trade with Tibet for tea, &c.

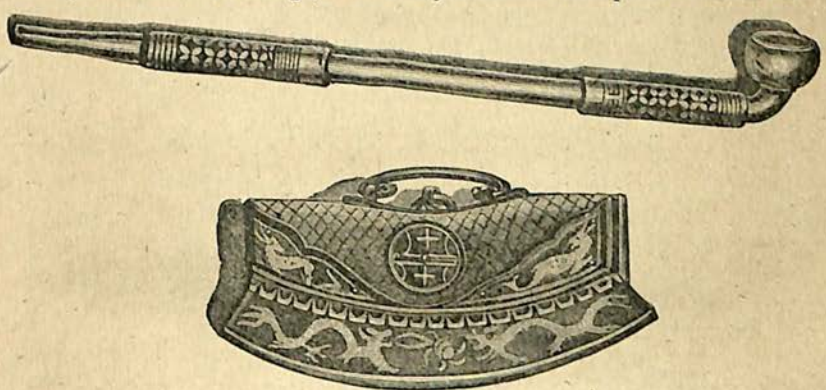
he was our attendant and spy, the most barefaced liar I ever met with, even in the east; and as cringing and obsequious when alone with us, as he was to his masters on other occasions, when he never failed to show off his authority over us in an offensive manner. Though he was the most disagreeable fellow we were ever thrown in contact with, I do not think that he was therefore selected, but solely from his possessing a few words of Hindostanee, and his presumed capability of playing the spy.

RAJAH'S RESIDENCE, AND THE HUT ASSIGNED TO US. ARRIVAL OF THE DEWAN.

The weather was generally drizzling or rainy, and we were getting very tired of our captivity; but I beguiled the time by carefully keeping my meteorological register,[1] and by reducing

[1] During the thirty days spent at Tumloong, the temperature was mild and equable, with much cloud and drizzle, but little hard rain; and we experienced violent thunder-storms, followed by transient sunshine. Unlike 1848, the rains did not cease this year before the middle of December; nor had there been one fine month since April. The mean temperature, computed from 150 observations, was 50° 2, and from the maximum and minimum thermometer

many of my previous observations. Each morning we were awakened at daybreak by the prolonged echoes of the conchs, trumpets, and cymbals, beaten by the priests before the many temples in the valley: wild and pleasing sounds, often followed by their choral chants. After dark we sat over the fire, generally in company with a little Lepcha girl, who was appointed to keep us in fire-wood, and who sat watching our movements with childish curiosity. Dolly, as we christened her, was a quick child and a kind one, intolerably dirty, but very entertaining from her powers of mimicry. She was fond of hearing me whistle airs, and procured me a Tibetan Jews'-harp,[1] with which, and coarse tobacco, which I smoked out of a Tibetan brass pipe, I wiled away the dark evenings, whilst my cheerful companion amused



TIBET PIPE AND TINDER-POUCH WITH STEEL ATTACHED.

himself with an old harmonicon, to the enchantment of Dolly and our guards and neighbours.

The messengers from Darjeeling were kept in utter ignorance

49° 6, which is a fair approximation to the theoretical temperature calculated for the elevation and month, and allows a fall of 1° for 320 feet of ascent. The temperature during the spring (from 50 observations) varied during the day from 2° 4 to 5° 8 higher than that of the air, the greatest differences occurring morning and evening. The barometric tide amounted to 0·091 between 9·50 A.M., and 4 P.M., which is less than at the level of the plains of India, and more than at any greater elevation than Tumloong. The air was always damp, nearly saturated at night, and the mean amount of humidity for ninety-eight observations taken during the day was only 0·850, corresponding to a dew-point of 49° 6, or 5° 2 below that of the air.

[1] This instrument (which is common in Tibet) is identical with the European, except that the tongue is produced behind the bow, in a strong steel spike, by which the instrument is held firmer to the mouth.

of our confinement till their arrival at Tumloong, when they were cross-questioned, and finally sent to us. They gradually became too numerous, there being only one apartment for ourselves, and such of our servants as were not imprisoned elsewhere. Some of them were frightened out of their senses, and the state of abject fear and trembling in which one Limboo arrived, and continued for nearly a week, was quite distressing[1] to every one except Dolly, who mimicked him in a manner that was irresistibly ludicrous. Whether he had been beaten or threatened we could not make out, nor whether he had heard of some dark fate impending over ourselves—a suspicion which would force itself on our minds; especially as Thoba-sing had coolly suggested to the Amlah the dispatching of Campbell, as the shortest way of getting out of the scrape! We were also ignorant whether any steps were being taken at Darjeeling for our release, which we felt satisfied must follow any active measures against these bullying cowards, though they themselves frequently warned us that we should be thrown into the Teesta if any such were pursued.

So long as our money lasted, we bought food, for the Durbar had none to give; and latterly my ever charitable companion fed our guards, including Dolly and Thoba-sing, in pity to their pinched condition. Several families sent us small presents, especially that of the late estimable Dewan, Ilam-sing, whose widow and daughters lived close by, and never failed to express in secret their sympathy and good feeling.

Tchebu Lama's and Meepo's families were equally forward in their desire to serve us; but they were marked men, and could only communicate by stealth.

Our coolies were released on the 18th, more than half starved, but the Sirdars were still kept in chains or the stocks: some were sent back to Darjeeling, and the British subjects billeted off amongst the villagers, and variously employed by the Dewan: my lad, Cheytoong, was set to collect the long leaves of a *Tupistra*, called "Purphiok," which yield a sweet juice, and were chopped up and mixed with tobacco for the Dewan's hookah.

[1] It amounted to a complete prostration of bodily and mental powers: the man trembled and started when spoken to, or at any noise, a cold sweat constantly bedewed his forehead, and he continued in this state for eight days. No kindness on Campbell's part could rouse him to give any intelligible account of his fears or their cause. His companions said he had lost his goroo, *i.e.*, his charm, which the priest gives him while yet a child, and which he renews or gets re-sanctified as occasion requires. To us the circumstance was extremely painful.

November 20th.—The Dewan, we heard this day, ignored all the late proceedings, professing to be enraged with his brother and the Amlah, and refusing to meddle in the matter. This was no doubt a pretence: we had sent repeatedly for an explanation with himself or the Rajah, from which he excused himself on the plea of ill-health, till this day, when he apprised us that he would meet Campbell, and a cotton tent was pitched for the purpose.

We went about noon, and were received with great politeness and shaking of hands by the Dewan, the young Gangtok Kajee, and the old monk who had been present at my examination at Phadong. Tchebu Lama's brother was also there, as a member of the Amlah, lately taken into favour; while Tchebu himself acted as interpreter, the Dewan speaking only Tibetan. They all sat cross-legged on a bamboo bench on one side, and we on chairs opposite them: walnuts and sweetmeats were brought us, and a small present in the Rajah's name, consisting of rice, flour, and butter.

The Dewan opened the conversation both in this and another conference, which took place on the 22nd, by requesting Campbell to state his reasons for having desired these interviews. Neither he nor the Amlah seemed to have the smallest idea of the nature and consequences of the acts they had committed, and they therefore anxiously sought information as to the view that would be taken of them by the British Government. They could not see why Campbell should not transact business with them in his present condition, and wanted him to be the medium of communication between themselves and Calcutta. The latter confined himself to pointing out his own views of the following subjects:—1. The seizing and imprisoning of the agent of a friendly power, travelling unarmed and without escort, under the formal protection of the Rajah, and with the authority of his own government. 2. The aggravation of this act of the Amlah, by our present detention under the Dewan's authority. 3. The chance of collision, and the disastrous consequences of a war, for which they had no preparation of any kind. 4. The impossibility of the supreme government paying any attention to their letters so long as we were illegally detained.

All this sank deep into the Dewan's heart: he answered, "You have spoken truth, and I will submit it all to the Rajah;" but at the same time he urged that there was nothing dishonourable in the imprisonment, and that the original violence being all a mistake, it should be overlooked by both parties. We parted on

good terms, and heard shortly after the second conference that our release was promised and arranged : when a communication [1] from Darjeeling changed their plans, the Dewan conveniently fell sick on the spot, and we were thrown back again.

In the meantime, however, we were allowed to write to our friends, and to receive money and food, of which we stood in great need. I transmitted a private account of the whole affair to Lord Dalhousie, who was unfortunately at Bombay, but to whose prompt and vigorous measures we were finally indebted for our release. His lordship expedited a despatch to the Rajah, such as the latter was accustomed to receive from Nepal, Bhotan, or Lhassa, and such as alone commands attention from these half-civilised Indo-Chinese, who measure power by the firmness of the tone adopted towards them ; and who, whether in Sikkim, Birmah, Siam, Bhotan, or China, have too long been accustomed to see every article of our treaties contravened, with no worse consequences than a protest or a threat, which is never carried into execution till some fatal step calls forth the dormant power of the British Government.[2]

The end of the month arrived without bringing any prospect of our release, whilst we were harassed by false reports of all kinds. The Dewan went on the 25th to a hot bath, a few hundred feet down the hill ; he was led past our hut, his burly frame tottering as if in great weakness, but a more transparent fraud could not have been practised : he was, in fact, lying on his oars, pending further negociations. The Amlah proposed that Campbell should sign a bond, granting immunity from all past offences on their part, whilst they were to withdraw the letter of grievances against him. The Lamas cast horoscopes for the future, little presents continually arrived for us, and the Ranee sent me some tobacco,

[1] I need scarcely say that every step was taken at Darjeeling for our release, that the most anxious solicitude for our safety could suggest. But the first communication to the Rajah, though it pointed out the heinous nature of his offence, was, through a natural fear of exasperating our captors, couched in very moderate language. The particulars of our seizure, and the reasons for it, and for our further detention, were unknown at Darjeeling, or a very different line of policy would have been pursued.

[2] We forget that all our concessions to these people are interpreted into weakness; that they who cannot live on an amicable equality with one another, cannot be expected to do so with us ; that all our talk of power and resources are mere boasts to habitual bullies, so long as we do not exert ourselves in the correction of premeditated insults. No Government can be more tolerant, more sincerely desirous of peace, and more anxious to confine its sway within its own limits than that of India, but it can only continue at peace by demanding respect, and the punctilious enforcement of even the most trifling terms in the treaties it makes with Indo-Chinese.

and to Campbell brown sugar and Murwa beer. The blacksmiths, who had ostentatiously been making long knives at the forge hard by, were dismissed; troops were said to be arriving at Darjeeling, and a letter sternly demanding our release had been received.

The Lamas of Pemiongchi, Changachelling, Tassiding, &c., and the Dewan's enemies, and Tchebu Lama's friends, began to flock from all quarters to Tumloong, demanding audience of the Rajah, and our instant liberation. The Dewan's game was evidently up; but the timidity of his opponents, his own craft, and the habitual dilatoriness of all, contributed to cause endless delays. The young Gangtok Kajee tried to curry favour with us, sending word that he was urging our release, and adding that he had some capital ponies for us to see on our way to Darjeeling! Many similar trifles showed that these people had not a conception of the nature of their position, or of that of an officer of the British Government.

The Tchebu Lama visited us only once, and then under surveillance; he renewed his professions of good faith, and we had every reason to know that he had suffered severely for his adherence to us, and consistent repudiation of the Amlah's conduct; he was in great favour with his brother Lamas, but was not allowed to see the Rajah, who was said to trust to him alone of all his counsellors. He told us that peremptory orders had arrived from Calcutta for our release, but that the Amlah had replied that they would not acknowledge the despatch, from its not bearing the Governor-General's great seal! The country-people refusing to be saddled with the keep of our coolies, they were sent to Darjeeling in small parties, charged to say that we were free, and following them.

The weather continued rainy and bad, with occasionally a few hours of sunshine, which, however, always rendered the ditch before our door offensive: we were still prevented leaving the hut, but as a great annual festival was going on, we were less disagreeably watched. Campbell was very unwell, and we had no medicine; and as the Dewan, accustomed to such duplicity himself, naturally took this for a *ruse*, and refused to allow us to send to Darjeeling for any, we were more than ever convinced that his own sickness was simulated.

On the 2nd and 3rd December we had further conferences with the Dewan, who said that we were to be taken to Darjeeling in six days, with two Vakeels from the Rajah. The Pemiongchi Lama, as the oldest and most venerated in Sikkim, attended, and

addressed Campbell in a speech of great feeling and truth. Having heard, he said, of these unfortunate circumstances a few days ago, he had come on feeble limbs, and though upwards of seventy winters old, as the representative of his holy brotherhood, to tender advice to his Rajah, which he hoped would be followed. Since Sikkim had been connected with the British rule, it had experienced continued peace and protection; whereas before they were in constant dread of their lives and properties, which, as well as their most sacred temples, were violated by the Nepalese and Bhotanese. He then dwelt upon Campbell's invariable kindness and good feeling, and his exertions for the benefit of their country, and for the cementing of friendship, and hoped he would not let these untoward events induce an opposite course in future; but that he would continue to exert his influence with the Governor-General in their favour.

The Dewan listened attentively; he was anxious and perplexed, and evidently losing his presence of mind: he talked to us of Lhassa and its gaieties, dromedaries, Lamás, and everything Tibetan; offered to sell us ponies cheap, and altogether behaved in a most undignified manner; ever and anon calling attention to his pretended sick leg, which he nursed on his knee. He gave us the acceptable news that the government at Calcutta had sent up an officer to carry on Campbell's duties, which had alarmed him exceedingly. The Rajah, we were told, was very angry at our seizure and detention; he had no fault to find with the Governor-General's agent, and hoped he would be continued as such. In fact, all the blame was thrown on the brothers of the Dewan, and of the Gangtok Kajee, and more irresponsible stupid boors could not have been found on whom to lay it, or who would have felt less inclined to commit such folly if it had not been put on them by the Dewan. On leaving, white silk scarfs were thrown over our shoulders, and we went away, still doubtful, after so many disappointments, whether we should really be set at liberty at the stated period.

Although there was so much talk about our leaving, our confinement continued as rigorous as ever. The Dewan curried favour in every other way, sending us Tibetan wares for purchase, with absurd prices attached, he being an arrant pedlar. All the principal families waited on us, desiring peace and friendship. The coolies who had not been dismissed were allowed to run away, except my Bhotan Sirdar, Nimbo, against whom the Dewan was inveterate:[1] he, however, managed soon afterwards to break

[1] The Sikkim people are always at issue with the Bhotanese. Nimbo was

a great chain with which his legs were shackled, and marching at night, eluded a hot pursuit, and proceeded to the Teesta, swam the river, and reached Darjeeling in eight days; arriving with a large iron ring on each leg, and a link of several pounds weight attached to one.

Parting presents arrived from the Rajah on the 7th, consisting of ponies, cloths, silks, woollens, immense squares of butter, tea, and the usual et ceteras, to the utter impoverishment of his stores: these he offered to the two Sahibs, "in token of his amity with the British government, his desire for peace, and deprecation of angry discussions." The Ranee sent silk purses, fans, and such Tibetan paraphernalia, with an equally amicable message, that "she was most anxious to avert the consequences of whatever complaints had gone forth against Dr. Campbell, who might depend on her strenuous exertions to persuade the Rajah to do whatever he wished!" These friendly messages were probably evoked by the information that an English regiment, with three guns, was on its way to Sikkim, and that 300 of the Bhaugulpore Rangers had already arrived there. The government of Bengal sending another agent[1] to Darjeeling, was also a contingency they had not anticipated, having fully expected to get rid of any such obstacle to direct communication with the Governor-General.

A present from the whole population followed that of the Ranee, coupled with earnest entreaties that Campbell would resume his position at Darjeeling; and on the following day forty coolies mustered to arrange the baggage. Before we left, the Ranee sent three rupees to buy a yard of chalé and some gloves, accompanying them with a present of white silk, &c., for Mrs. Campbell, to whom the commission was intrusted: a singular instance of the *insouciant* simplicity of these odd people.

The 9th of December was a splendid and hot day, one of the very few we had during our captivity. We left at noon, descending the hill through an enormous crowd of people, who brought farewell presents, all wishing us well. We were still under escort as prisoners of the Dewan, who was coolly marching a troop of forty unloaded mules and ponies, and double that number of men's loads of merchandise, purchased during the summer in Tibet, to trade with at Darjeeling and the Titalya fair! His impudence or

a runaway slave of the latter country, who had been received into Sikkim, and retained there until he took up his quarters at Darjeeling.

[1] Mr. Lushington, the gentleman sent to conduct Sikkim affairs during Dr. Campbell's detention: to whom I shall ever feel grateful for his activity in our cause, and his unremitting attention to every little arrangement that could alleviate the discomforts and anxieties of our position.

stupidity was thus quite inexplicable; treating us as prisoners, ignoring every demand of the authorities at Darjeeling, of the Supreme Council of Calcutta, and of the Governor-General himself; and at the same time acting as if he were to enter the British territories on the most friendly and advantageous footing for himself and his property, and incurring so great an expense in all this as to prove that he was in earnest in thinking so.

Tchebu Lama accompanied us, but we were not allowed to converse with him. We halted at the bottom of the valley, where the Dewan invited us to partake of tea; from this place he gave us mules[1] or ponies to ride, and we ascended to Yankoong, a village 3,867 feet above the sea. On the following day we crossed a high ridge from the Ryott valley to that of the Rungmi; where we camped at Tikbotang (alt. 3,763 feet), and on the 11th at Gangtok Sampoo, a few miles lower down the same valley.

We were now in the Soubahship of the Gangtok Kajee, a member of the oldest and most wealthy family in Sikkim; he had from the first repudiated the late acts of the Amlah, in which his brother had taken part, and had always been hostile to the Dewan. The latter conducted himself with disagreeable familiarity towards us, and *hauteur* towards the people; he was preceded by immense kettle-drums, carried on men's backs, and great hand-bells, which were beaten and rung on approaching villages; on which occasions he changed his dress of sky-blue for yellow silk robes worked with Chinese dragons, to the indignation of Tchebu Lama, an amber robe in polite Tibetan society being sacred to royalty and the Lamas. We everywhere perceived unequivocal symptoms of the dislike with which he was regarded. Cattle were driven away, villages deserted, and no one came to pay respects, or bring presents, except the Kajees, who were ordered to attend, and his elder brother, for whom he had usurped an estate near Gangtok.

On the 13th, he marched us a few miles, and then halted for a day at Serriomsa (alt. 2,820 feet), at the bottom of a hot valley full of irrigated rice-crops and plantain and orange-groves. Here the Gangtok Kajee waited on us with a handsome present, and informed us privately of his cordial hatred of the "upstart Dewan," and hopes for his overthrow; a demonstration of which we took no notice.[2] The Dewan's brother (one of the Amlah) also sent a

[1] The Tibet mules are often as fine as the Spanish: I rode one which had performed a journey from Choombi to Lhassa in fifteen days, with a man and load.

[2] Nothing would have been easier than for the Gangtok Kajee, or any other

large present, but was ashamed to appear. Another letter reached the Dewan here, directed to the Rajah; it was from Lord Dalhousie, who was then at Bombay, and had been sent across the country by special messengers: it demanded our instant release, or his Raj would be forfeited; and declared that if a hair of our heads were touched, his life should be the penalty.

The Rajah was also incessantly urging the Dewan to hasten us onwards as free men to Dárjeeling, but the latter took all remonstrances with assumed coolness, exercised his ponies, played at bow and arrow, intruded on us at mealtimes to be invited to partake, and loitered on the road, changing garments and hats, which he pestered us to buy. Nevertheless, he was evidently becoming daily more nervous and agitated.

From the Rungmi valley we crossed on the 14th southward to that of Runniok, and descended to Dikkeeling, a large village, of Dhurma Bhoteeas (Bhotanese), which is much the most populous, industrious, and at the same time turbulent, in Sikkim. It is 4,950 feet above the sea, and occupies many broad cultivated spurs facing the south. This district once belonged to Bhotan, and was ceded to the Sikkim Rajah by the Paro Pilo,[1] in consideration of some military services, rendered by the former in driving off the Tibetans, who had usurped it for the authorities of Lhassa. Since then the Sikkim and Bhotan people have repeatedly fallen out, and Dikkeeling has become a refuge for runaway Bhotanese, and kidnapping is constantly practised on this frontier.

The Dewan halted us here for three days, for no assigned cause. On the 16th, letters arrived, including a most kind and encouraging one from Mr. Lushington, who had taken charge of Campbell's office at Darjeeling. Immediately after arriving, the messenger was seized with violent vomitings and gripings: we could not help suspecting poison, especially as we were now amongst adherents of the Dewan, and the Bhotanese are notorious for this crime. Only one means suggested itself for proving this, and with Campbell's permission I sent my compliments to the Dewan, with a request for one of his hunting dogs to eat the vomit. It was sent at once, and performed its duty without any ill effects. I must confess to having felt a malicious pleasure in the opportunity

respectable man in Sikkim, to have overthrown the Dewan and his party; but these people are intolerable apathetic, and prefer being tyrannised over to the trouble of shaking off the yoke.

[1] The temporal sovereign, in contra-distinction to the Dhurma Rajah, or spiritual sovereign of Bhotan.

thus afforded of showing our jailor how little we trusted him; feeling indignant at the idea that he should suppose he was making any way in our good opinion by his familiarities, which we were not in circumstances to resist.

The crafty fellow, however, outwitted me by inviting us to dine with him the same day, and putting our stomachs and noses to a severe test. Our dinner was served in Chinese fashion, but most of the luxuries, such as *bêche-de-mer*, were very old and bad. We ate, sometimes with chop-sticks, and at others with Tibetan spoons, knives, and two-pronged forks. After the usual amount of messes served in oil and salt water, sweets were brought, and a strong spirit. Thoba-sing, our filthy, cross-eyed spy, was waiter, and brought in every little dish with both hands, and raised it to his greasy forehead, making a sort of half bow previous to depositing it before us. Sometimes he undertook to praise its contents, always adding, that in Tibet none but very great men indeed partook of auch sumptuous fare. Thus he tried to please both us and the Dewan, who conducted himself with pompous hospitality, showing off what he considered his elegant manners and graces. Our blood boiled within us at being so patronised by the squinting ruffian, whose insolence and ill-will had sorely aggravated the discomforts of our imprisonment.

Not content with giving us what he considered a magnificent dinner (and it had cost him some trouble), the Dewan produced a little bag from a double-locked escritoire, and took out three dinner-pills, which he had received as a great favour from the Rimbochay Lama, and which were a sovereign remedy for indigestion and all other ailments: he handed one to each of us, reserving the third for himself. Campbell refused his; but there appeared no help for me, after my groundless suspicion of poison, and so I swallowed the pill with the best grace I could. But in truth it was not poison I dreaded in its contents, so much as being compounded of some very questionable materials, such as the Rimbochay Lama blesses and dispenses far and wide. To swallow such is a sanctifying work, according to Boodhist superstition, and I believe there is nothing in the world, save his ponies, to which the Dewan attached a greater value.

To wind up the feast, we had pipes of excellent mild yellow Chinese tobacco called "Tseang," made from *Nicotiana rustica*, which is cultivated in East Tibet; and in West China, according to MM. Huc and Gabet. It resembles in flavour the finest Syrian tobacco, and is most agreeable when the smoke is passed through the nose. The common tobacco of India (*Nicotiana Tabacum*) is

much imported into Tibet, where it is called "Tamma" (probably a corruption of the Persian "Toombac"), and is said to fetch the enormous price of 30*s.* per lb. at Lhassa, which is sixty times its value in India. Rice at Lhassa, when cheap, sells at 2*s.* for 5 lbs.; it is, as I have elsewhere said, all bought up for rations for the Chinese soldiery.

The Bhotanese are more industrious than the Lepchas, and better husbandmen; besides having superior crops of all ordinary grains, they grow cotton, hemp, and flax. The cotton is cleansed here as elsewhere, with a simple gin. The Lepchas use no spinning wheel, but a spindle and distaff; their loom, which is Tibetan, is a very complicated one framed of bamboo; it is worked by hand, without beam, treadle, or shuttle.

On the 18th we were marched, three miles only, to Singdong (alt. 2,116 feet), and on the following day five miles farther, to Katong Ghat (alt. 750 feet), on the Teesta river, which we crossed with rafts, and camped on the opposite bank, a few miles above the junction of this river with the Great Rungeet. The water, which is sea-green in colour, had a temperature of 53° 5 at 4 P.M., and 51° 7 the following morning; its current was very powerful. The rocks, since leaving Tumloong, had been generally micaceous, striking north-west and dipping north-east. The climate was hot, and the vegetation on the banks tropical; on the hills around, lemon-bushes ("Kucheala," Lepcha) were abundant, growing apparently wild.

The Dewan was now getting into a very nervous and depressed state; he was determined to keep up appearances before his followers, but was himself almost servile to us: he caused his men to make a parade of their arms, as if to intimidate us, and in descending narrow gullies we had several times the disagreeable surprise of finding some of his men at a sudden turn, with drawn bows and arrows pointed towards us. Others gesticulated with their long knives, and made fell swoops at soft plantain-stems; but these artifices were all as shallow as they were contemptible, and a smile at such demonstrations was generally answered with another from the actors.

From Katong we ascended the steep east flank of Tendong or Mount Ararat, through forests of Sal and long leaved pine, to Namten (alt. 4,483 feet), where we again halted two days. The Dingpu Tinli lived near, and waited on us with a present, which, with all others that had been brought, Campbell received officially, and transferred to the authorities at Darjeeling.

The Dewan was thoroughly alarmed at the news here brought

in, that the Rajah's present of yaks, ponies, &c., which had been sent forward, had been refused at Darjeeling; and equally so at the clamorous messages which reached him from all quarters demanding our liberation; and at the desertion of some of his followers, on hearing that large bodies of troops were assembling at Darjeeling. Repudiated by his Rajah and countrymen, and paralysed between his dignity and his ponies, which he now perceived would not be welcomed at the station, and which were daily losing flesh, looks, and value in these hot valleys, where there is no grass pasture, he knew not what olive-branch to hold out to our government, except ourselves, whom he therefore clung to as hostages.

On the 22nd of December he marched us eight miles further, to Cheadam, on a bold spur 4,653 feet high, overlooking the Great Rungeet, and facing Darjeeling, from which it was only twenty miles distant. The white bungalows of our friends gladdened our eyes, while the new barracks erecting for the daily arriving troops struck terror into the Dewan's heart. The six Sepoys [1] who had marched valiantly beside us for twenty days, carrying the muskets given to the Rajah the year before by the Governor-General, now lowered their arms, and vowed that if a red coat crossed the Great Rungeet, they would throw down their guns and run away. News arrived that the Bhotan inhabitants of Darjeeling, headed by my bold Sirdar Nimbo, had arranged a night attack for our release: an enterprise to which they were quite equal, and in which they have had plenty of practice in their own misgoverned country. Watch-fires gleamed amongst the bushes, and we were thrust into a doubly-guarded house, and bows and arrows were ostentatiously levelled so as to rake the doorway, should we attempt to escape. Some of the ponies were sent back to Dikkeeling, though the Dewan still clung to his merchandise and the feeble hope of traffic. The confusion increased daily, but though Tchebu Lama looked brisk and confident, we were extremely anxious; scouts were hourly arriving from the road to the Great Rungeet, and if our troops had advanced, the Dewan might have made away with us from pure fear.

In the forenoon he paid us a long visit, and brought some flutes, of which he gave me two very common ones of apricot wood from Lhassa, producing at the same time a beautiful one, which I

[1] These Sepoys, besides the loose red jacket and striped Lepcha kirtle, wore a very curious national black hat of felt, with broad flaps turned up all round: this is represented in the right-hand figure. A somewhat similar hat is worn by some classes of Nepal soldiery.

believe he intended for Campbell, but his avarice got the better, and he commuted his gift into the offer of a tune, and pitching it in a high key, he went through a Tibetan air that almost deafened us by his screech. He tried bravely to maintain his equanimity, but as we preserved a frigid civility and only spoke when addressed, the tears would start from his eyes in the pauses of conversation. In the evening he came again; he was excessively agitated and covered with perspiration, and thrust himself unceremoniously

LEPCHA SEPOYS. TIBETAN SEPOYS IN THE BACKGROUND.
(See p. 403.)

between us on the bench we occupied. As his familiarity increased, he put his arm round my neck, and as he was armed with a small dagger, I felt rather uneasy about his intentions, but he ended by forcing on my acceptance a coin, value threepence, for he was in fact beside himself with terror.

Next morning Campbell received a hint that this was a good opportunity for a vigorous remonstrance. The Dewan came with

Tchebu Lama, his own younger brother (who was his pony driver), and the Lassoo Kajee. The latter had for two months placed himself in an attitude of hostility opposite Darjeeling, with a ragged company of followers, but he now sought peace and friendship as much as the Dewan; the latter told us he was waiting for a reply to a letter addressed to Mr. Lushington, after which he would set us free. Campbell said: "As you appear to have made up your mind, why not dismiss us at once?" He answered that we should go the next day at all events. Here I came in, and on hearing from Campbell what had passed, I added, that he had better for his own sake let us go at once; that the next day was our great and only annual Poojah (religious festival) of Christmas, when we all met; whereas he and his countrymen had dozens in the year. As for me, he knew I had no wife, nor children, nor any relation, within thousands of miles, and it mattered little where I was, he was only bringing ruin on himself by his conduct to me as the Governor-General's friend; but as regarded Campbell the case was different; his home was at Darjeeling, which was swarming with English soldiers, all in a state of exasperation, and if he did not let us depart before Christmas he would find Darjeeling too hot to hold him, let him offer what reparation he might for the injuries he had done us. I added: "We are all ready to go—dismiss us." The Dewan again turned to Campbell, who said, "I am quite ready; order us ponies at once, and send our luggage after us." He then ordered the ponies, and three men, including Meepo, to attend us; whereupon we walked out, mounted, and made off with all speed.

We arrived at the cane bridge over the Great Rungeet at 4 P.M., and to our chagrin found it in the possession of a posse of ragged Bhoteeas, though there were thirty armed Sepoys of our own at the guard-house above. At Meepo's order they cut the network of fine canes by which they had rendered the bridge impassable, and we crossed. The Sepoys at the guard-house turned out with their clashing arms and bright accoutrements, and saluted to the sound of bugles; scaring our three companions, who ran back as fast as they could go. We rode up that night to Darjeeling, and I arrived at 8 P.M. at Hodgson's house, where I was taken for a ghost, and received with shouts of welcome by my kind friend and his guest Dr. Thomson, who had been awaiting my arrival for upwards of a month.

Thus terminated our Sikkim captivity, and my last Himalayan exploring journey, which in a botanical and geographical point of view had answered my purposes beyond my most sanguine expecta-

tions, though my collections had been in a great measure destroyed by so many untoward events. It had enabled me to survey the whole country, and to execute a map of it, and Campbell had further gained that knowledge of its resources which the British government should all along have possessed, as the protector of the Rajah and his territories.

It remains to say a few words of the events that succeeded our release, in so far as they relate to my connection with them. The Dewan moved from Cheadam to Namtchi, immediately opposite Darjeeling, where he remained throughout the winter. The supreme government of Bengal demanded of the Rajah that he should deliver up the most notorious offenders, and come himself to Darjeeling, on pain of an army marching to Tumloong to enforce the demand: a step which would have been easy, as there were neither troops, arms, ammunition, nor other means of resistance, even had there been the inclination to stop us, which was not the case. The Rajah would in all probability have delivered himself up at Tumloong, throwing himself on our mercy, and the army would have sought the culprits in vain, both the spirit and the power to capture them being wanting on the part of the people and their ruler.

The Rajah expressed his willingness, but pleaded his inability to fulfill the demand, whereupon the threat was repeated, and additional reinforcements were moved on to Darjeeling. The general officer in command at Dinapore was ordered to Darjeeling to conduct operations: his skill and bravery had been proved during the progress of the Nepal war so long ago as 1815. From the appearance of the country about Darjeeling, he was led to consider Sikkim to be impracticable for a British army. This was partly owing to the forest-clad mountains, and partly to the fear of Tibetan troops coming to the Rajah's aid, and the Nepalese[1] taking the opportunity to attack us. With the latter we were in profound peace, and we had a residence at their court; and I have elsewhere shown the impossibility of a Tibetan invasion, even if the Chinese or Lhassan authorities were inclined to interfere in the affairs of Sikkim, which they long ago formally declined doing

[1] Jung Bahadoor was at this time planning his visit to England, and to his honour I must say, that on hearing of our imprisonment he offered to the government at Calcutta to release us with a handful of men. This he would no doubt have easily effected, but his offer was wisely declined, for the Nepalese (as I have elsewhere stated) want Sikkim and Bhotan too, and we had undertaken the protection of the former country, mainly to keep the Nepalese out of it.

in the case of aggressions of the Nepalese and Bhotanese, the Sikkim Rajah being under British protection.[1]

There were not wanting offers of leading a company of soldiers to Tumloong, rather than that the threat should have been twice made, and then withdrawn; but they were not accepted. A large body of troops was however marched from Darjeeling, and encamped on the north bank of the Great Rungeet for some weeks: but after that period they were recalled, without any further demonstration: the Dewan remaining encamped the while on the Namtchi hill, not three hours' march above them. The simple Lepchas daily brought our soldiers milk, fowls, and eggs, and would have continued to do so had they proceeded to Tumloong, for I believe both Rajah and people would have rejoiced at our occupation of the country.

After the withdrawal of the troops, the threat was modified into a seizure of the Terai lands, which the Rajah had originally received as a free gift from the British, and which were the only lucrative or fertile estates he possessed. This was effected by four policemen taking possession of the treasury (which contained exactly twelve shillings, I believe), and announcing to the villagers the confiscation of the territory to the British government, in which they gladly acquiesced. At the same time there was annexed to

[1] The general officer considered that our troops would have been cut to pieces if they entered the country; and the late General Sir Charles Napier has since given evidence to the same effect. Having been officially asked at the time whether I would guide a party into the country, and having drawn up (at the request of the general officer) plans for the purpose, and having given it as my opinion that it would not only have been feasible but easy to have marched a force in peace and safety to Tumloong, I feel it incumbent on me here to remark, that I think General Napier, who never was in Sikkim, and wrote from many hundred miles' distance, must have misapprehended the state of the case. Whether an invasion of Sikkim was either advisable or called for, was a matter in which I had no concern; nor do I offer an opinion as to the impregnability of the country if it were defended by natives otherwise a match for a British force, and having the advantage of position. I was not consulted with reference to any difference of opinion between the civil and military powers, such as seems to have called for the expression of Sir Charles Napier's opinion on this matter, and which appears to be considerably overrated in his evidence.

The general officer honoured me with his friendship at Darjeeling, and to Mr. Lushington, I am, as I have elsewhere stated, under great obligation for his personal consideration and kindness, and vigorous measures during my detention. On my release and return to Darjeeling, any interference on my part would have been meddling with what was not my concern. I never saw, nor wished to see, a public document connected with the affair, and have only given as many of the leading features of the case as I can vouch for, and as were accessible to any other bystander.

it the whole southern part of Sikkim, between the Great Rungeet and the plains of India, and from Nepal on the west to the Bhotan frontier and the Teesta river on the east; thus confining the Rajah to his mountains, and cutting off all access to the plains, except through the British territories. To the inhabitants (about 5,000 souls) this was a matter of congratulation, for it only involved the payment of a small fixed tax in money to the treasury at Darjeeling, instead of a fluctuating one in kind, with service to the Rajah, besides exempting them from further annoyance by the Dewan. At the present time the revenues of the tract thus acquired have doubled, and will very soon be quadrupled: every expense of our detention and of the moving of troops, &c., has been already repaid by it, and for the future all will be clear profit; and I am given to understand that this last year it has realized upwards of 30,000 rupees (£3,000).

Dr. Campbell resumed his duties immediately afterwards, and the newly-acquired districts were placed under his jurisdiction. The Rajah still begs hard for the renewal of old friendship, and the restoration of his Terai land, or the annual grant of £300 a year which he formerly received. He has forbidden the culprits his court, but can do no more. The Dewan, disgraced and turned out of office, is reduced to poverty, and is deterred from entering Tibet by the threat of being dragged to Lhassa with a rope round his neck. Considering, however, his energy, a rare quality in these countries, I should not be surprised at his yet cutting a figure in Bhotan, if not in Sikkim itself: especially if, at the Rajah's death, the British government should refuse to take the country under its protection. The Singtam Soubah and the other culprits live disgraced at their homes. Tchebu Lama has received a handsome reward, and a grant of land at Darjeeling, where he resides, and whence he sends me his salaams by every opportunity.

CHAPTER XXVII.

Leave Darjeeling for Calcutta—Jung Bahadoor—Dr. Falconer—Improvements in Botanic Gardens—Palmetum—Victoria—*Amherstia*—Orchids spread by seed—Banyan—*Cycas*—Importation of American plants in ice—Return to Darjeeling—Leave with Dr. Thomson for the Khasia mountains—Mahanuddy river—Vegetation of banks—Maldah—Alligators—Rampore-Bauleah—Climate of Ganges—Pubna—Jummul river—Altered course of Burrampooter and Megna—Dacca—Conch shells—Saws—Cotton muslins—Fruit—Vegetation—Elevation—Rose of Bengal—Burrampooter—Delta of Soormah river—Jheels—Soil—Vegetation—Navigation—Mosquitos—Atmospheric pressure—Effects of geological changes—Imbedding of plants—Teelas or islets—Chattuc—Salubrious climate—Rains—Canoes—Pundua—Mr. Harry Inglis—Terrya Ghat—Ascent to Churra—Scenery and vegetation at foot of mountains—Cascades.

I WAS chiefly occupied during January and February of 1850, in arranging and transmitting my collections to Calcutta, and completing my manuscripts, maps, and surveys. My friend Dr. Thomson having joined me here, for the purpose of our spending a year in travelling and botanising together, it became necessary to decide on the best field for our pursuits. Bhotan offered the most novelty, but it was inaccessible to Europeans; and we therefore turned our thoughts to Nepal, and failing that, to the Khasia mountains.

The better to expedite our arrangements, I made a trip to Calcutta in March, where I expected to meet both Lord Dalhousie, on his return from the Straits of Malacca, and Jung Bahadoor (the Nepalese minister), who was then *en route* as envoy to England. I stayed at Government House, where every assistance was afforded me towards obtaining the Nepal Rajah's permission to proceed through the Himalaya from Darjeeling to Katmandu. Jung Bahadoor received me with much courtesy, and expressed his great desire to serve me; but begged me to wait until his return from England, as he could not be answerable for my personal safety when travelling during his absence; and he referred to the permission he had formerly given me (and such was never before accorded to any European) in earnest of his disposition, which was unaltered. We therefore determined upon spending the season of 1850 in the Khasia mountains in eastern Bengal, at the head of the great delta of the Ganges and Burrampooter.

I devoted a few days to the Calcutta Botanic Gardens, where I found my kind friend Dr. Falconer established, and very busy. The destruction of most of the palms, and of all the noble tropical features of the gardens, during Dr. Griffith's incumbency,

had necessitated the replanting of the greater part of the grounds, the obliteration of old walks, and the construction of new: it was also necessary to fill up tanks whose waters, by injudicious cuttings, were destroying some of the most valuable parts of the land, to drain many acres, and to raise embankments to prevent the encroachments of the Hoogly: the latter being a work attended with great expense, now cripples the resources of the garden library, and other valuable adjuncts; for the trees which

DR. FALCONER'S RESIDENCE, CALCUTTA BOTANIC GARDENS, FROM SIR L. PEEL'S GROUNDS.

were planted for the purpose having been felled and sold, it became necessary to buy timber at an exorbitant price.

The avenue of Cycas trees (*Cycas circinalis*), once the admiration of all visitors, and which for beauty and singularity was unmatched in any tropical garden, had been swept away by the same unsparing hand which had destroyed the teak, mahogany, clove, nutmeg, and cinnamon groves. In 1848, when I first visited the establishment, nothing was to be seen of its former

beauty and grandeur, but a few noble trees or graceful palms rearing their heads over a low ragged jungle, or spreading their broad leaves or naked limbs over the forlorn hope of a botanical garden, that consisted of open clay beds, disposed in concentric circles, and baking into brick under the fervid heat of a Bengal sun.

The rapidity of growth is so great in this climate, that within eight months from the commencement of the improvements, a great change had already taken place. The grounds bore a park-like appearance; broad shady walks had replaced the narrow winding paths that ran in distorted lines over the ground, and a large Palmetum, or collection of tall and graceful palms of various kinds, occupied several acres at one side of the garden; whilst a still larger portion of ground was being appropriated to a picturesque assemblage of certain closely allied families of plants, whose association promised to form a novel and attractive object of study to the botanist, painter, and landscape gardener. This, which the learned Director called in scientific language a Thamno-Endogenarium, consists of groups of all kinds of bamboos, tufted growing palms, rattan canes (*Calami*), *Dracænæ*, plantains, screw-pines (*Pandani*), and such genera of tropical monocotyledonous plants. All are evergreens of most vivid hue, some of which, having slender trailing stems, form magnificent masses; others twine round one another, and present impenetrable hillocks of green foliage; whilst still others shoot out broad long wavy leaves from tufted roots; and a fourth class is supported by aerial roots, diverging on all sides and from all heights on the stems, every branch of which is crowned with an enormous plume of grass-like leaves.[1]

The great *Amherstia* tree had been nearly killed by injudicious treatment, and the baking of the soil above its roots. This defect was remedied by sinking bamboo pipes four feet and a half in the earth, and watering through them—a plan first recommended by Major M'Farlane of Tavoy. Some fine *Orchideæ* were in flower in the gardens, but few of them fruit; and those *Dendrobiums* which bear axillary viviparous buds never do. Some of the orchids appear to be spread by birds amongst the trees; but the different species of *Vanda* are increasing so fast, that there

[1] Since I left India, these improvements have been still further carried out, and now (in the spring of 1853) I read of five splendid *Victoria* plants flowering at once, with *Euryale ferox*, white, blue, and red water-lilies, and white, yellow, and scarlet lotus, rendering the tanks gorgeous, sunk as their waters are in frames of green grass, ornamented with clumps of *Nipa fruticans* and *Phœnix paludosa*.

seems no doubt that this tribe of air-plants grows freely from seed in a wild state, though we generally fail to rear them in England.

The great Banyan tree (*Ficus Indica*) is still the pride and ornament of the garden. Dr. Falconer has ascertained satisfactorily that it is only seventy-five years old: annual rings, size, &c., afford no evidence in such a case, but people were alive a few years ago who remembered well its site being occupied in 1782 by a Kujoor (Date-palm), out of whose crown the Banyan sprouted, and beneath which a Fakir sat. It is a remarkable fact that the Banyan hardly ever vegetates on the ground; but its figs are eaten by birds, and the seeds deposited in the crowns of palms, where they grow, sending down roots that embrace and eventually kill the palm, which decays away. This tree is now eighty feet high, and throws an area 300 feet[1] in diameter into a dark, cool shade. The gigantic limbs spread out about ten feet above the ground, and from neglect during Dr. Wallich's absence, there were on Dr. Falconer's arrival no more than eighty-nine descending roots or props; there are now several hundreds, and the growth of this grand mass of vegetation is proportionably stimulated and increased. The props are induced to sprout by wet clay and moss tied to the branches, beneath which a little pot of water is hung, and after they have made some progress, they are inclosed in bamboo tubes, and so coaxed down to the ground. They are mere slender whip-cords before reaching the earth, where they root, remaining very lax for several months; but gradually, as they grow and swell to the size of cables, they tighten, and eventually become very tense. This is a curious phenomenon, and so rapid, that it appears to be due to the rooting part mechanically dragging down the aerial. The branch meanwhile continues to grow outwards, and being supplied by its new support, thickens beyond it, whence the props always slant outwards from the ground towards the circumference of the tree.

Cycas trees abound in the gardens, and, though generally having only one, or rarely two crowns, they have sometimes sixteen, and their stems are everywhere covered with leafy buds, which are

[1] Had this tree been growing in 1849 over the great palm-stove at Kew, only thirty feet of each end of that vast structure would have been uncovered: its increase was then proceeding so rapidly, that by this time it could probably cover the whole. Larger banyans are common in Bengal; but few are so symmetrical in shape and height. As the tree gets old, it breaks up into separate masses, the original trunk decaying, and the props becoming separate trunks of the different portions.

developed on any check being given to the growth of the plant, as by the operation of transplantation, which will cause as many as 300 buds to appear in the course of a few years, on a trunk eight feet high.

During my stay at the gardens, Dr. Falconer received a box of living plants packed in moss, and transported in a frozen state by one of the ice ships from North America:[1] they left in November, and arriving in March, I was present at the opening of the boxes, and saw 391 plants (the whole contents) taken out in the most perfect state. They were chiefly fruit-trees, apples, pears, peaches, currants, and gooseberries, with beautiful plants of the Venus' fly-trap (*Dionæa muscipula*). More perfect success never attended an experiment: the plants were in vigorous bud, and the day after being released from their icy bonds, the leaves sprouted and unfolded, and they were packed in Ward's cases for immediate transport to the Himalaya mountains.

My visit to Calcutta enabled me to compare my instruments with the standards at the Observatory, in which I was assisted by my friend Capt. Thuillier, to whose kind offices on this and many other occasions I am greatly indebted.

I returned to Darjeeling on the 17th of April, and Dr. Thomson and I commenced our arrangements for proceeding to the Khasia mountains. We started on the 1st of May, and I bade adieu to Darjeeling with no light heart; for I was leaving the kindest and most disinterested friends I had ever made in a foreign land, and a country whose mountains, forests, productions, and people had all become endeared to me by many ties and associations. The prospects of Darjeeling itself are neither doubtful nor insignificant. Whether or not Sikkim will fall again under the protection of Britain, the station must prosper, and that very speedily. I had seen both its native population and its European houses doubled in two years; its salubrious climate, its scenery, and accessibility, ensure it so rapid a further increase that it will become the most populous hill-station in India. Strong prejudices against a damp climate, and the complaints of loungers and idlers who only seek pleasure, together with a groundless fear of the natives, have hitherto retarded its progress; but its natural advantages will outweigh these and all other obstacles.

I am aware that my opinion of the ultimate success of Dar-

[1] The ice from these ships is sold in the Calcutta market for a penny a pound, to great profit; it has already proved an invaluable remedy in cases of inflammation and fever, and has diminished mortality to a very appreciable extent.

jeeling is not shared by the general public of India, and must be pardoned for considering their views in this matter short-sighted. With regard to the disagreeables of its climate, I can sufficiently appreciate them, and shall be considered by the residents to have over-estimated the amount and constancy of mist, rain, and humidity, from the two seasons I spent there being exceptional in these respects. Whilst on the one hand I am willing to admit the probability of this,[1] I may be allowed on the other to say that I have never visited any spot under the sun, where I was not told that the season was exceptional, and generally for the worse; added to which there is no better and equally salubrious climate east of Nepal, accessible from Calcutta.

All climates are comparative, and fixed residents naturally praise their own. I have visited many latitudes, and can truly say that I have found no two climates resembling each other, and that all alike are complained of. That of Darjeeling is above the average in point of comfort, and for perfect salubrity rivals any; while in variety, interest, and grandeur, the scenery is unequalled.

From Sikkim to the Khasia mountains our course was by boat down the Mahanuddy to the upper Gangetic delta, whose many branches we followed eastwards to the Megna; whence we ascended the Soormah to the Silhet district. We arrived at Kishengunj, on the Mahanuddy, on the 3rd of May, and were delayed two days for our boat, which should have been waiting here to take us to Berhampore on the Ganges: we were, however, hospitably received by Mr. Perry's family.

The approach of the rains was indicated by violent easterly storms of thunder, lightning, and rain; the thermometer ranging from 70° to 85°. The country around Kishengunj is flat and very barren; it is composed of a deep sandy soil, covered with a short turf, now swarming with cockchafers. Water is found ten or twelve feet below the surface, and may be supplied by underground streams from the Himalaya, distant forty-five miles. The river, which at this season is low, may be navigated up to Titalya during the rains; its bed averages 60 yards in width, and is extremely tortuous; the current is slight, and, though shallow, the water is opaque. We slowly descended to Maldah, where we arrived on the 11th: the temperature both of the water and of the air increased rapidly to upwards of 90°; the former was always a

[1] I am informed that hardly a shower of rain has fallen this season, between November 1852, and April 1853; and a very little snow in February only.

few degrees cooler than the air by day, and warmer by night. The atmosphere became drier as we receded from the mountains.

The boatmen always brought up by the shore at night; and our progress was so slow, that we could keep up with the boat when walking along the bank. So long as the soil and river-bed continued sandy, few bushes or herbs were to be found, and it was difficult to collect a hundred kinds of plants in a day: gradually, however, clumps of trees appeared, with jujube bushes, *Trophis*, *Acacia*, and *Buddleia*, a few fan-palms, bamboos, and Jack-trees. A shell (*Anodon*) was the only one seen in the river, which harboured few water-plants or birds, and neither alligators nor porpoises ascend so high.

On the 7th of May, about eighty miles in a straight line from the foot of the Himalaya, we found the stratified sandy banks, which had gradually risen to a height of thirteen feet, replaced by the hard alluvial clay of the Gangetic valley, which underlies the sand: the stream contracted, and the features of its banks were materially improved by a jungle of tamarisk, wormwood (*Artemisia*), and white rose-bushes (*Rosa involucrata*), whilst mango trees became common, with tamarinds, banyan, and figs. Date and *Caryota* palms, and rattan canes, grew in the woods, and parasitic Orchids on the trees, which were covered with a climbing fern (*Acrosticum scandens*), so that we easily doubled our flora of the river banks before arriving at Maldah.

This once populous town is, like Berhampore, now quite decayed, since the decline of its silk and indigo trades: the staple product, called "Maldy," a mixture of silk and cotton, very durable, and which washes well, now forms its only trade, and is exported through Sikkim to the north-west provinces and Tibet. It is still famous for the size and excellence of its mangos, which ripen late in May; but this year the crop had been destroyed by the damp heats of spring, the usual north-west dry winds not having prevailed.

The ruins of the once famous city of Gour, a few miles distant, are now covered with jungle, and the buildings are fast disappearing, owing to the bricks being carried away to be used elsewhere.

Below Maldah the river gets broader, and willow becomes common. We found specimens of a *Planorbis* in the mud of the stream, and saw apparently a boring shell in the alluvium, but could not land to examine it. Chalky masses of alligators' droppings, like coprolites, are very common, buried in the banks, which become twenty feet high at the junction with the Ganges,

where we arrived on the 14th. The waters of this great river were nearly two degrees cooler than those of the Mahanuddy.

Rampore-Bauleah is a large station on the north bank of the Ganges, whose stream is at this season fully a mile wide, with a very slow current; its banks are thirty feet above the water. We were most kindly received by Mr. Bell, the collector of the district, to whom we were greatly indebted for furthering us on our voyage: boats being very difficult to procure, we were, however, detained here from the 16th to the 19th. I was fortunate in being able to compare my barometers with a first-rate standard instrument, and in finding no appreciable alteration since leaving Calcutta in the previous April. The elevation of the station is 130 feet above the sea, that of Kishengunj I made 131; so that the Gangetic valley is nearly a dead level for fully a hundred miles north, beyond which it rises; Titalya, 150 miles to the north, being 360 feet, and Siligoree, at the margin of the Terai, rather higher. The river again falls more considerably than the land; the Mahanuddy, at Kishengunj, being about twenty feet below the level of the plains, or 110 above the sea; whereas the Ganges, at Rampore, is probably not more than eighty feet, even when the water is highest.

The climate of Rampore is marked by greater extremes than that of Calcutta: during our stay the temperature rose above 106°, and fell to 78° at night: the mean was 2½° higher than at Calcutta, which is 126 miles further south. Being at the head of the Gangetic delta, which points from the Sunderbunds obliquely to the north-west, it is much damper than any locality further west, as is evidenced by two kinds of *Calamus* palm abounding, which do not ascend the Ganges beyond Monghyr. Advancing eastwards, the dry north-west wind of the Gangetic valley, which blows here in occasional gusts, is hardly felt; and easterly winds, rising after the sun (or, in other words, following the heating of the open dry country), blow down the great valley of the Burrampooter, or south-easterly ones come up from the Bay of Bengal. The western head of the Gangetic delta is thus placed in what are called "the variables" in naval phraseology; but only so far as its superficial winds are concerned, for its great atmospheric current always blows from the Bay of Bengal, and flows over all northern India, to the lofty regions of Central Asia.

At Rampore I found the temperature of the ground, at three feet depth, varied from 87° 8 to 89° 8, being considerably lower than that of the air (94° 2), whilst that of a fine ripening shaddock, into which I plunged a thermometer bulb, varied little from 81°,

whether the sun shone on it or not. From this place we made very slow progress south-eastwards, with a gentle current, but against constant easterly winds, and often violent gales and thunder-storms, which obliged us to bring up under shelter of banks and islands of sand. Sometimes we sailed along the broad river, whose opposite shores were rarely both visible at once, and at others tracked the boat through narrow creeks that unite the many Himalayan streams, and form a network soon after leaving their mountain valleys

A few miles beyond Pubna we passed from a narrow canal at once into the main stream of the Burrampooter at Jaffergunj: our maps had led us to expect that it flowed fully seventy miles to the eastward in this latitude; and we were surprised to hear that within the last twenty years the main body of that river had shifted its course thus far to the westward. This alteration was not effected by the gradual working westwards of the main stream, but by the old eastern channel so rapidly silting up as to be now unnavigable; while the Jummul, which receives the Teesta, and which is laterally connected by branches with the Burrampooter, became consequently wider and deeper, and eventually the principal stream.

Nothing can be more dreary and uninteresting than the scenery of this part of the delta. The water is clay-coloured and turbid, always cooler than the air, which again was 4° or 5° below that of Calcutta, with a damper atmosphere. The banks are of stratified sand and mud, hardly raised above the mean level of the country, and consequently unlike those bordering most annually flooded rivers; for here the material is so unstable, that the current yearly changes its course. A wiry grass sometimes feebly binds the loose soil, on which there are neither houses nor cultivation.

Ascending the Jummul (now the main channel of the Burrampooter) for a few miles, we turned off into a narrower channel, sixty miles long, which passes by Dacca, where we arrived on the 28th, and where we were again detained for boats, the demand for which is rapidly increasing with the extended cultivation of the Sunderbunds and Delta. We stayed with Mr. Atherton, and botanised in the neighbourhood of the town, which was once very extensive, and is still large, though not flourishing. The population is mostly Mahometan; the site, though beautiful and varied, is unhealthy for Europeans. Ruins of great Moorish brick buildings still remain, and a Greek style of ornamenting the houses prevails to a remarkable degree.

The manufacture of rings for the arms and ankles, from conch-

shells imported from the Malayan Archipelago, is still almost confined to Dacca: the shells are sawn across for this purpose by semicircular saws, the hands and toes being both actively employed in the operation. The introduction of circular saws has been attempted by some European gentlemen, but steadily resisted by the natives, despite their obvious advantages. The Dacca muslin manufacture, which once employed thousands of hands, is quite at an end, so that it was with great difficulty that the specimens of these fabrics sent to the Great Exhibition of 1851, were procured. The kind of cotton (which is very short in the staple) employed, is now hardly grown, and scarcely a loom exists which is fit for the finest fabrics. The jewellers still excel in gold and silver filagree.

Pine-apples, plantains, mangos, and oranges, abound in the Dacca market, betokening a better climate for tropical fruits than that of Western Bengal; and we also saw the fruit of *Euryale ferox*,[1] which is round, soft, pulpy, and the size of a small orange; it contains from eight to fifteen round black seeds as large as peas, which are full of flour, and are eaten roasted in India and China, in which latter country the plant is said to have been in cultivation for upwards of 3,000 years.

The native vegetation is very similar to that of the Hoogly, except that the white rose is frequent here. The fact of a plant of this genus being as common on the plains of Bengal as a dog-rose is in England, and associated with cocoa-nuts, palms, mangos, plantains, and banyans, has never yet attracted the attention of botanists, though the species was described by Roxburgh. As a geographical fact it is of great importance, for the rose is usually considered a northern genus, and no kind but this inhabits a damp hot tropical climate. Even in mountainous countries situated near the equator, as in the Himalaya and Andes, wild roses are very rare, and only found at great elevations, whilst they are unknown in the southern hemisphere. It is curious that this rose, which is also a native of Birma and the Indian Peninsula, does not in this latitude grow west of the meridian of 87°; it is confined to the upper Gangetic delta, and inhabits a climate in which it would least of all be looked for.

[1] An Indian water-lily with a small red flower, covered everywhere with prickles, and so closely allied to *Victoria regia* as to be scarcely generically distinguishable from it. It grows in the eastern Sunderbunds, and also in Kashmir. The discoverer of Victoria called the latter "*Euryale Amazonica*." These interesting plants are growing side by side in the new Victoria house at Kew. The Chinese species has been erroneously considered different from the Indian one.

I made the elevation of Dacca by barometer only seventy-two feet above the sea; and the banks of the Dallisary being high, the level of its waters at this season is scarcely above that of the Bay of Bengal. The mean temperature of the air was 86¾ during our stay, or half a degree lower than Calcutta at the same period.

We pursued our voyage on the 30th of May, to the old bed of the Burrampooter, an immense shallow sheet of water, of which the eastern bank is for eighty miles occupied by the delta of the Soormah. This river rises on the Munnipore frontier, and flows through Cachar, Silhet, and the Jheels of east Bengal, receiving the waters of the Cachar, Jyntea, Khasia, and Garrow mountains (which bound the Assam valley to the south), and of the Tipperah hills, which stretch parallel to them, and divide the Soormah valley from the Bay of Bengal. The immense area thus drained by the Soormah is hardly raised above the level of the sea, and covers about 10,000 square miles. The anastomosing rivers that traverse it, flow very gently, and do not materially alter their course; hence their banks gradually rise above the mean level of the surrounding country, and on them the small villages are built, surrounded by extensive rice-fields that need no artificial irrigation. At this season the general surface of the Jheels is marshy; but during the rains, which are excessive on the neighbouring mountains, they resemble an inland sea, the water rising gradually to within a few inches of the floor of the huts; as, however, it subsides as slowly in autumn, it commits no devastation. The communication is at all seasons by boats, in the management of which the natives (chiefly Mahometans) are expert.

The want of trees and shrubs is the most remarkable feature of the Jheels; in which respect they differ from the Sunderbunds, though the other physical features of each are similar, the level being exactly the same: for this difference there is no apparent cause, beyond the influence of the tide and sea atmosphere. Long grasses of tropical genera (*Saccharum*, *Donax*, *Andropogon*, and *Rottbœllia*) ten feet high, form the bulk of the vegetation, with occasional low bushes along the firmer banks of the natural canals that everywhere intersect the country; amongst these the rattan cane (*Calamus*), rose, a laurel, *Stravadium*, and fig, are the most common; while beautiful convolvuli throw their flowering shoots across the water.

The soil, which is sandy along the Burrampooter, is more muddy and clayey in the centre of the Jheels, with immense spongy accumulations of vegetable matter in the marshes, through which we poked the boat-staves without finding bottom: they

were for the most part formed of decomposed grass roots, with occasionally leaves, but no quantity of moss or woody plants. Along the courses of the greater streams drift timber and various organic fragments are no doubt imbedded, but as there is no current over the greater part of the flooded surface, there can be little or no accumulation, except perhaps of old canoes, or of such vegetables as grow on the spot. The waters are dark-coloured, but clear and lucid, even at their height.

We proceeded up the Burrampooter, crossing it obliquely; its banks were on the average five miles apart, and formed of sand, without clay, and very little silt or mud: the water was clear and brown, like that of the Jheels, and very different from that of the Jummul. We thence turned eastwards into the delta of the Soormah, which we traversed in a north-easterly direction to the stream itself. We often passed through very narrow channels, where the grasses towered over the boats: the boatmen steered in and out of them as they pleased, and we were utterly at a loss to know how they guided themselves, as they had neither compass nor map, and there were few villages or landmarks; and on climbing the mast we saw multitudes of other masts and sails peering over the grassy marshes, doing just the same as we did. All that go up have the south-west wind in their favour, and this helps them to their course, but beyond this they have no other guide but that instinct which habit begets. Often we had to retreat from channels that promised to prove short cuts, but which turned out to be blind alleys. Sometimes we sailed up broader streams of chesnut-brown water, accompanied by fleets of boats repairing to the populous districts at the foot of the Khasia, for rice, timber, lime, coal, bamboos, and long reeds for thatching, all of which employ an inland navy throughout the year in their transport to Calcutta.

Leeches and mosquitos were very troublesome, the latter appearing in clouds at night; during the day they were rarer, but the species was the same. A large cray-fish was common, but there were few birds and no animals to be seen.

Fifty-four barometric observations, taken at the level of the water on the voyage between Dacca and the Soormah, and compared with Calcutta, showed a gradual rise of the mercury in proceeding eastwards; for though the pressure at Calcutta was ·055 of an inch higher than at Dacca, it was ·034 lower than on the Soormah: the mean difference between all these observations and the cotemporaneous ones at Calcutta was + ·003 in favour of Calcutta, and the temperature half a degree lower; the dew-point

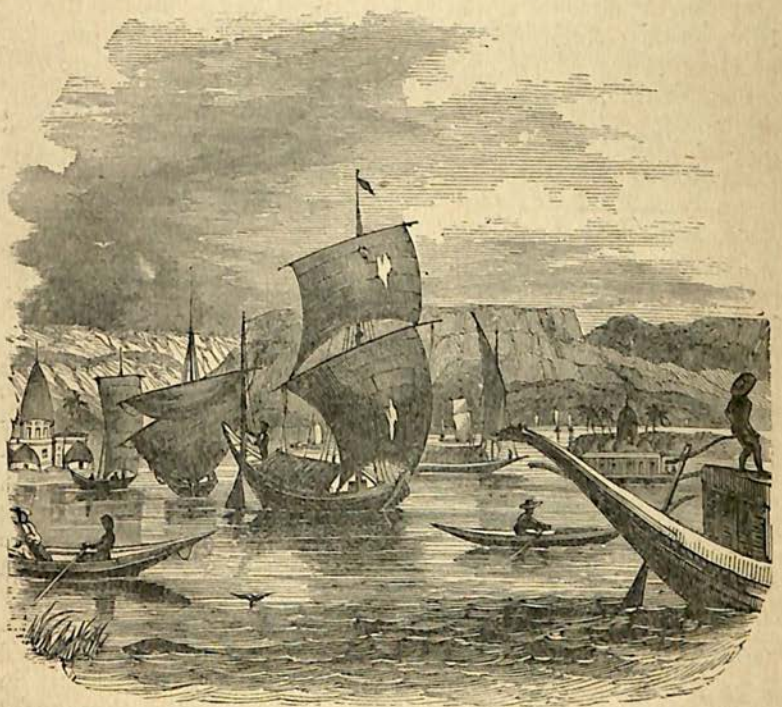
and humidity were nearly the same at both places. This being the driest season of the year, it is very probable that the mean level of the water at this part of the delta is not higher than that of the Bay of Bengal; but as we advanced northwards towards the Khasia, and entered the Soormah itself, the atmospheric pressure increased further, thus appearing to give the bed of that stream a depression of thirty-five feet below the Bay of Bengal, into which it flows! This was no doubt the result of unequal atmospheric pressure at the two localities, caused by the disturbance of the column of atmosphere by the Khasia mountains; for in December of the same year, thirty-eight observations on the surface of the Soormah made its bed forty-six feet *above* the Bay of Bengal, whilst from twenty-three observations on the Megna, the pressure only differed + 0·020 of an inch from that of the barometer at Calcutta, which is eighteen feet above the sea-level.

These barometric levellings, though far from satisfactory as compared with trigonometric, are extremely interesting in the absence of the latter. In a scientific point of view nothing has been done towards determining the levels of the land and waters of the great Gangetic delta, since Rennell's time, yet no geodetical operation promises more valuable results in geography and physical geology than running three lines of level across its area; from Chittagong to Calcutta, from Silhet to Rampore, and from Calcutta to Silhet. The foot of the Sikkim Himalaya has, I believe, been connected with Calcutta by the great trigonometrical survey, but I am given to understand that the results are not published.

My own barometric levellings would make the bed of the Mahanuddy and Ganges at the western extremity of the delta, considerably higher than I should have expected, considering how gentle the current is, and that the season was that of low water. If my observations are correct, they probably indicate a diminished pressure, which is not easily accounted for, the lower portion of the atmospheric column at Rampore being considerably drier and therefore heavier than at Calcutta. At the eastern extremity again, towards Silhet, the atmosphere is much damper than at Calcutta, and the barometer should therefore have stood lower, indicating a higher level of the waters than is the case.

To the geologist the Jheels and Sunderbunds are a most instructive region, as whatever may be the mean elevation of their waters, a permanent depression of ten to fifteen feet would submerge an immense tract, which the Ganges, Burrampooter, and Soormah would soon cover with beds of silt and sand. There

would be extremely few shells in the beds thus formed, the southern and northern divisions of which would present two very different floras and faunas, and would in all probability be referred by future geologists to widely different epochs. To the north, beds of peat would be formed by grasses, and in other parts, temperate and tropical forms of plants and animals would be preserved in such equally balanced proportions as to confound the palæontologist ; with the bones of the long-snouted alligator,



VIEW IN THE JHEELS.

Gangetic porpoise, Indian cow, buffalo, rhinoceros, elephant, tiger, deer, boar, and a host of other animals, he would meet with acorns of several species of oak, pine-cones and magnolia fruits, rose seeds, and *Cycas* nuts, with palm nuts, screw-pines, and other tropical productions. On the other hand, the Sunderbunds portion, though containing also the bones of the tiger, deer, and buffalo, would have none of the Indian cow, rhinoceros, or elephant; it would contain other species of porpoise, alligator,

and deer, and none of the above mentioned plants (*Cycas*, oak, pine, magnolia and rose), which would be replaced by numerous others, all distinct from those of the Jheels, and many of them indicative of the influence of salt water, whose proximity (from the rarity of sea-shells) might not otherwise be suspected.

On the 1st of June we entered the Soormah, a full and muddy stream flowing west, a quarter of a mile broad, with banks of mud and clay twelve or fifteen feet high, separating it from marshes, and covered with betel-nut and cocoa-nut palms, figs, and banyans. Many small villages were scattered along the banks, each with a swarm of boats, and rude kilns for burning the lime brought from the Khasia mountains, which is done with grass and bushes. We ascended to Chattuc, against a gentle current, arriving on the 9th.

From this place the Khasia mountains are seen as a long table-topped range running east and west, about 4,000 to 5,000 feet high, with steep faces towards the Jheels, out of which they appear to rise abruptly. Though twelve miles distant, large waterfalls are very clearly seen precipitating themselves over the cliffs into a bright green mass of foliage that seems to creep half way up their flanks. The nearly horizontal arrangement of the strata is as conspicuous here, as in the sandstone of the Kymore hills in the Soane valley, which these mountains a good deal resemble; but they are much higher, and the climate is widely different. Large valleys enter the hills, and are divided by hog-backed spurs, and it is far within these valleys that the waterfalls and precipices occur; but the nearer and further cliffs being thrown by perspective into one range, they seem to rise out of the Jheels so abruptly as to remind one of some precipitous island in the ocean

Chattuc is mainly indebted for its existence to the late Mr. Inglis, who resided there for upwards of sixty years, and opened a most important trade between the Khasia and Calcutta in oranges, potatoes, coal, lime, and timber. We were kindly received by his son, whose bungalow occupies a knoll, of which there are several, which attracted our attention as being the only elevations fifty feet high which we had ascended since leaving the foot of the Sikkim Himalaya. They rise as islets (commonly called Teela, Beng.) out of the Jheels, within twelve to twenty miles of the Khasia; they are chiefly formed of stratified gravel and sand, and are always occupied by villages and trees. They seldom exceed sixty feet in height, and increase in number and size as the hills are approached; they are probably the remains of a deposit that was

once spread uniformly along the foot of the mountains, and they in all respects resemble those I have described as rising abruptly from the plains near Titalya (see p. 269).

The climate of Chattuc is excessively damp and hot throughout the year, but though sunk amid interminable swamps, the place is perfectly healthy! Such indeed is the character of the climate throughout the Jheels, where fevers and agues are rare; and though no situations can appear more malarious to the common observer than Silhet and Cachar, they are in fact eminently salubrious. These facts admit of no explanation in the present state of our knowledge of endemic diseases. Much may be attributed to the great amount and purity of the water, the equability of the climate, the absence of forests and of sudden changes from wet to dry; but such facts afford no satisfactory explanation. The water, as I have above said, is of a rich chesnut-brown in the narrow creeks of the Jheels, and is golden yellow by transmitted light, owing no doubt, as in bog water and that of dunghills, to a vegetable extractive and probably the presence of carburetted hydrogen. Humboldt mentions this dark-coloured water as prevailing in some of the swamps of the Cassiquares, at the junction of the Orinoco and Amazon, and gives much curious information on its accompanying features of animal and vegetable life.

The rains generally commence in May: they were unusually late this year, though the almost daily gales and thunder-storms we experienced, foretold their speedy arrival. From May till October they are unremitting, and the country is under water, the Soormah rising about fifty feet. North-easterly winds prevail, but they are local currents reflected from the Khasia, against which the southerly perennial trade-wind impinges. Westerly winds are very rare, but the dry north-west blasts of India have been known to traverse the delta and reach this meridian, in one or two short hot dry puffs during March and April. Hoarfrost is unknown.[1]

China roses and tropical plants (*Bignoniæ*, *Asclepiadeæ*, and *Convolvuli*) rendered Mr. Inglis' bungalow gay, but little else will grow in the gardens. Pine-apples are the best fruit, and oranges from the foot of the Khasia: plantains ripen imperfectly, and the mango is always acid, attacked by grubs, and having a flavour of turpentine. The violent hailstorms of the vernal equinox cut both spring and cold season flowers and vegetables, and the rains destroy all summer products. The soil is a wet clay, in which

[1] It however forms further south, at the very mouth of the Megna, and is the effect of intense radiation when the thermometer in the shade falls to 45°.

some European vegetables thrive well if planted in October or November. We were shown marrowfat peas that had been grown for thirty years without degenerating in size, but their flavour was poor.

Small long canoes, paddled rapidly by two men, were procured here, whereby to ascend the narrow rivers that lead up to the foot of the mountains: they each carry one passenger, who lies along the bottom, protected by a bamboo platted arch roof. We started at night, and early the next morning arrived at Pundua,[1] where there is a dilapidated bungalow: the inhabitants are employed in the debarkation of lime, coal, and potatoes. Large fleets of boats crowded the narrow creeks, some of the vessels being of several tons burden.

Elephants were kindly sent here for us by Mr. H. Inglis, to take us to the foot of the mountains, about three miles distant, and relays of mules and ponies to ascend to Churra, where we were received with the greatest hospitality by that gentleman, who entertained us till the end of June, and procured us servants and collectors. To his kind offices we were also indebted throughout our travels in the Khasia, for much information, and for facilities and necessaries of all kinds; things in which the traveller is more dependent on his fellow countrymen in India, than in any other part of the world.

We spent two days at Pundua, waiting for our great boats (which drew several feet of water), and collecting in the vicinity. The old bungalow, without windows and with the roof falling in, was a most miserable shelter; and whichever way we turned from the door, a river or a swamp lay before us. Birds, mosquitos, leeches, large wasps, rats, and sandflies swarmed. A more pestilential-looking hole cannot be conceived; and yet people traverse this district, and sleep here at all seasons of the year with impunity. We did so ourselves in the month of June, when the Sikkim and all other Terais are deadly: we returned in September, traversing the Jheels and nullahs at the very foot of the hills during a short break of fine weather in the middle of the rains; and we again slept here in November,[2] always exposed in the heat of the day

[1] Pundua, though an insignificant village, surrounded by swamps, has enjoyed an undue share of popularity as a botanical region. Before the geographical features of the country north of Silhet were known, the plants brought from those hills by native collectors were sent to the Calcutta garden (and thence to Europe) as from Pundua. Hence Silhet mountains and Pundua mountains, both very erroneous terms, are constantly met with in botanical works, and generally refer to plants growing in the Khasia mountains.

[2] At the north foot of the Khasia, in the heavily timbered dry Terai stretch-

to wet and fatigue, and never having even a *soupçon* of fever, ague, or rheumatism. This immunity does not, however, extend to the very foot of the hills, as it is considered imprudent to sleep at this season in the bungalow of Terrya, only three miles off.

The elevation of Pundua bungalow is about forty feet above the sea, and that of the waters surrounding it, from ten to thirty, according to the season. In June the mean of the barometer readings at the bungalow was absolutely identical with that of the Calcutta barometer. In September it was 0·016 inch lower, and in November 0·066 lower. The mean annual temperature throughout the Jheels is less than 2° below that of Calcutta.

Terrya bungalow lies at the very foot of the first rise of the mountains; on the way we crossed many small streams upon the elephants, and one large one by canoes: the water in all was cool [1] and sparkling, running rapidly over boulders and pebbles. Their banks of sandy clay were beautifully fringed with a willow-like laurel, *Ehretia* bushes, bamboos, palms, *Bauhinia*, *Bombax*, and *Erythrina*, over which *Calamus* palm (rattan) and various flowering plants climbed. The rock at Terrya is a nummulitic limestone, worn into extensive caverns. This formation is said to extend along the southern flank of the Khasia, Garrow, and Jyntea mountains, and to be associated with sandstone and coal: it is extensively quarried in many places, several thousand tons being annually shipped for Calcutta and Dacca. It is succeeded by a horizontally stratified sandstone, which continued up to 4,000 feet, where it is overlain by coal-beds, and then by limestone again.

The sub-tropical scenery of the lower and outer Sikkim Himalaya, though on a much more gigantic scale, is not comparable in beauty and luxuriance with the really tropical vegetation induced by the hot, damp, and insular climate of these perennially humid mountains. On the Himalaya forests of gigantic trees, many of them deciduous, appear from a distance as masses of dark gray foliage, clothing mountains 10,000 feet high: here the individual trees are smaller, more varied in kind, of a brilliant green, and

ing for sixty miles to the Burrampooter, it is almost inevitable death for a European to sleep, at any time between the end of April and of November. Many have crossed that track, but not one without taking fever: Mr. H. Inglis was the only survivor of a party of five, and he was ill from the effects for upwards of two years, after having been brought to death's door by the first attack, which came on within three weeks of his arrival at Churra, and by several relapses.

[1] Temperature in September 77° to 80°; and in November 75·7°.

contrast with gray limestone and red sandstone rocks and silvery cataracts. Palms are more numerous here;[1] the cultivated *Areca* (betel-nut) especially, raising its graceful stem and feathery crown, "like an arrow shot down from heaven," in luxuriance and beauty above the verdant slopes. This difference is at once expressed to the Indian botanist by defining the Khasia flora as of Malayan character; by which is meant the prevalence of brilliant glossy-leaved evergreen tribes of trees (as *Euphorbiaceæ* and *Urticeæ*), especially figs, which abound in the hot gulleys, where the property of their roots, which inosculate and form natural grafts, is taken advantage of in bridging streams, and in constructing what are called living bridges, of the most picturesque forms. *Combretaceæ*, oaks, oranges, *Garcinia* (gamboge), *Diospyros*, figs, Jacks, plantains, and *Pandanus*, are more frequent here, together with pinnated leaved *Leguminosæ*, *Meliaceæ*, vines and peppers, and above all palms, both climbing ones with pinnated shining leaves (as *Calamus* and *Plectocomia*), and erect ones with similar leaves (as cultivated cocoa-nut, *Areca* and *Arenga*), and the broader-leaved wild betel-nut, and beautiful *Caryota* or wine-palm, whose immense decompound leaves are twelve feet long. Laurels and wild nutmegs, with *Henslowia*, *Itea*, &c., were frequent in the forest, with the usual prevalence of parasites, mistleto, epiphytical *Orchideæ*, *Æschynanthus*, ferns, mosses, and *Lycopodia;* and on the ground were *Rubiaceæ*, *Scitamineæ*, ferns, *Acanthaceæ*, beautiful balsams, and herbaceous and shrubby nettles. Bamboos[2] of many kinds are very abundant, and these hills further differ re-

[1] There are upwards of twenty kinds of Palm in this district, including *Chamærops*, three species of *Areca*, two of *Wallichia*, *Arenga*, *Caryota*, three of *Phœnix*, *Plectocomia*, *Licuala*, and many species of *Calamus*. Besides these there are several kinds of *Pandanus*, and the *Cycas pectinata*.

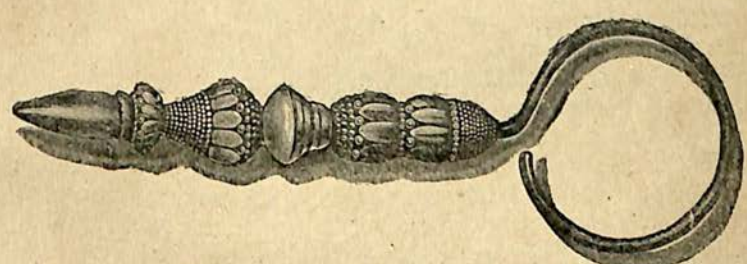
[2] The natives enumerate about fourteen different kinds of bamboo, of which we found five in flower, belonging to three very distinct genera. Uspár, Uspét, Uspít, Uskén, Uskóng, Uktáng, Ustó, Silee, Namlang, Tirra, and Battooba are some of the names of Bamboos vouched for by Mr. Inglis as correctly spelt. Of other Khasia names of plants, Wild Plantains are called Kairem, and the cultivated Kakesh; the latter are considered so nourishing that they are given to new-born infants. Senteo is a flower in Khas, So a fruit, Ading a tree, and Tè a leaf. *Pandanus* is Kashelan. *Plectocomia*, Usmole. *Licuala*, Kuslow. *Caryota*, Kalaikatang. *Wallichia*, Kalai-nili. *Areca*, Waisola. Various *Calami* are Rhimét, Uriphin, Ureek hilla, Tindrio, &c. This list will serve as a specimen: I might increase it materially, but as I have elsewhere observed, the value attached to the supposed definite application of native names to natural objects is greatly over-rated, and too much reliance on them has introduced a prodigious amount of confusion into scientific works and philological inquiries.

"LIVING BRIDGE," FORMED OF THE AERIAL ROOTS OF THE INDIA-RUBBER AND OTHER KINDS OF FIGS.

markably from those of Sikkim in the great number of species of grasses.

The ascent was at first gradual, along the sides of a sandstone spur. At 2,000 feet the slope suddenly became steep and rocky; at 3,000 feet tree vegetation disappeared, and we opened a magnificent prospect of the upper scarped flank of the valley of Moosmai, which we were ascending, with four or five beautiful cascades rolling over the table top of the hills, broken into silvery foam as they leapt from ledge to ledge of the horizontally stratified precipice, and throwing a veil of silver gauze over the gulf of emerald green vegetation, 2,000 feet below. The views of the many cataracts of the first class that are thus precipitated over the bare table-land on which Churra stands, into the valleys on either side, surpass anything of the kind that I have elsewhere seen, though in many respects vividly recalling the scenery around Rio de Janeiro: nor do I know any spot in the world more calculated to fascinate the naturalist who, while appreciating the elements of which a landscape is composed, is also keenly alive to the beauty and grandeur of tropical scenery.

At the point where this view opens, a bleak stony region commences, bearing numberless plants of a temperate flora and of European genera, at a comparatively low elevation; features which continue to the top of the flat on which the station is built, 4,000 feet above the sea.



DEWAN'S EAR-RING.

CHAPTER XXIX.

Churra, English station of—Khasia people—Garrow people—Houses—Habits—Dress—Arms—Dialects—Marriages—Food—Funerals—Superstitions—Flat of Churra—Scenery—Lime and coal—Mamloo—Cliffs—Cascades—*Chamærops* palm—Jasper-rocks—Flora of Churra—Orchids—Rhododendrons—Pine—Climate—Extraordinary rain-fall—Its effects—Gardens of Lieuts. Raban and Cave—Leave Churra to cross the mountain range—Coal, shale, and under-clay—Kala-panee river—Lailangkot—*Luculia Pinceana*—Conglomerate—Sururcem wood—Boga-panee river—View of Himalaya—Green-stone—Age of Pine-cones—Mollong plants—*Coix*—Chillong mountain—Extensive view—Road to Syong—Broad valeys—Geology—Plants—Myrung—Granite blocks—Kollong rock—Pine-woods—Features of country—Orchids—Iron forges.

CHURRA POONJI is said to be so called from the number of streams in the neighbourhood, and poonji, "a village" (Khas.): it was selected for a European station, partly from the elevation and consequent healthiness of the spot, and partly from its being on the high road from Silhet to Gowahatty, on the Burrampooter, the captal of Assam, which is otherwise only accessible by ascending that river, against both its current and the perennial east wind. A rapid postal communication is hereby secured: but the extreme unhealthiness of the northern foot of the mountains effectually precludes all other intercouse for nine months in the year.

On the first opening up of the country, the Europeans were brought into sanguinary collision with the Khasias, who fought bravely with bows and arrows, displaying a most blood-thirsty and cruel disposition. This is indeed natural to them; and murders continued very frequent as preludes to the most trifling robberies, until the extreme penalty of our law was put in force. Even now, some of the tributary Rajahs are far from quiet under our rule, and various parts of the country are not safe to travel in. The Garrows, who occupy the western extremity of this range, at the bend of the Burrampooter, are still in a savage state. Human sacrifices and polyandry are said to be frequent amongst them, and their orgies are detestable. Happily we are hardly ever brought into collision with them, except by their occasional depredations on the Assam and Khasia frontier: their country is very unhealthy, and is said to contain abundance of coal, iron, and lime.

We seldom employed fewer than twelve or fourteen of the natives as collectors, and when travelling, from thirty to forty as coolies, &c. They are averse to rising early, and are intolerably filthy in their persons, though not so in their cottages, which are

very poor, with broad grass roofs reaching nearly to the ground, and usually encircled by bamboo fences; the latter custom is not common in savage communities, and perhaps indicates a dread of treachery. The beams are of hewn wood (they do not use saws), often neatly carved, and the doors turn on good wooden pivots. They have no windows, and the fire is made on the floor: the utensils, &c. are placed on hanging shelves and in baskets.

The Khasia people are of the Indo-Chinese race; they are short, very stout, and muscular, with enormous calves and knees, rather narrow eyes and little beard, broad, high cheekbones, flat noses, and open nostrils. I believe that a few are tattooed. The hair is gathered into a top-knot, and sometimes shaved off the forehead and temples. A loose cotton shirt, often striped blue and red, without sleeves and bordered with long thread fringes, is their principal garment; it is gathered into a girdle of silver chains by people of rank. A cotton robe is sometimes added, with a large cotton turban or small skull-cap. The women wear a long cloth tied in a knot across the breast. During festivals both men and women load themselves with silk robes, fans, peacock's feathers, and gold and silver ornaments of great value, procured from Assam, many of which are said to be extremely curious, but I regret to say that I never saw any of them. On these occasions spirits are drunk, and dancing kept up all night: the dance is described as a slow ungraceful motion, the women being tightly swathed in cloths.

All their materials are brought from Assam; the only articles in constant use, of their own manufacture, being a rude sword or knife with a wooden handle and a long, narrow, straight blade of iron, and the baskets with head-straps, like those used by the Lepchas, but much neater; also a netted bag of pine-apple fibre (said to come from Silhet) which holds a clasp-knife, comb, flint, steel, and betel-nut box. They are much addicted to chewing pawn (betel-nut, pepper leaves, and lime) all day long, and their red saliva looks like blood on the paths. Besides the sword I have described, they carry bows and arrows, and rarely a lance, and a bamboo wicker-work shield.

We found the Khasias to be sulky intractable fellows, contrasting unpleasantly with the Lepchas; wanting in quickness, frankness, and desire to please, and obtrusively independent in manner; nevertheless we had a head man who was very much the reverse of this, and whom we had never any cause to blame. Their language is, I believe, Indo-Chinese and monosyllabic: it is disagreeably nasal and guttural, and there are several dialects and

accents in contiguous villages. All inflections are made by prefixing syllables, and when using the Hindoo language, the future is invariably substituted for the past tense. They count up to a hundred, and estimate distances by the number of mouthfuls of pawn they eat on the road.

Education has been attempted by missionaries with partial success, and the natives are said to have shown themselves apt scholars. Marriage is a very loose tie amongst them, and hardly any ceremony attends it. We were informed that the husband does not take his wife home, but enters her father's household, and is entertained there. Divorce and an exchange of wives is common, and attended with no disgrace: thus the son often forgets his father's name and person before he grows up, but becomes strongly attached to his mother. The sister's son inherits both property and rank, and the proprietors' or Rajahs' offspring are consequently often reared in poverty and neglect. The usual toy of the children is the bow and arrow, with which they are seldom expert; they are said also to spin pegtops like the English, climb a greased pole, and run round with a beam turning horizontally on an upright, to which it is attached by a pivot.

The Khasias eat fowls, and all meat, especially pork, potatos and vegetables, dried and half putrid fish in abundance, but they have an aversion to milk, which is very remarkable, as a great proportion of their country is admirably adapted for pasturage. In this respect, however, they assimilate to the Chinese, and many Indo-Chinese nations who are indifferent to milk, as are the Sikkim people. The Bengalees, Hindoos, and Tibetans, on the other hand, consume immense quantities of milk. They have no sheep, and few goats or cattle, the latter of which are kept for slaughter; they have, however, plenty of pigs and fowls. Eggs are most abundant, but used for omens only, and it is a common, but disgusting occurrence, to see large groups employed for hours in breaking them upon stones, shouting and quarrelling, surrounded by the mixture of yellow yolks and their red pawn saliva.

The funeral ceremonies are the only ones of any importance, and are often conducted with barbaric pomp and expense; and rude stones of gigantic proportions are erected as monuments, singly or in rows, circles, or supporting one another, like those of Stonehenge, which they rival in dimensions and appearance. The body is burned, though seldom during the rains, from the difficulty of obtaining a fire; it is therefore preserved in honey (which is

CHURRA STATION AND THE JHEELS, FROM THE KHASIA MOUNTAINS.

abundant and good) till the dry season: a practice I have read of as prevailing among some tribes in the Malay peninsula. Spirits are drunk on these occasions; but the hill Khasia is not addicted to drunkenness, though some of the natives of the low valleys are very much so. These ascend the rocky faces of the mountains by ladders, to the Churra markets, and return loaded at night, apparently all but too drunk to stand; yet they never miss their footing in places which are most dangerous to persons unaccustomed to such situations.

The Khasias are superstitious, but have no religion; like the Lepchas, they believe in a supreme being, and in deities of the grove, cave, and stream. Altercations are often decided by holding the disputants'. heads under water, when the longest winded carries his point. Fining is a common punishment, and death for grave offences. The changes of the moon are accounted for by the theory that this orb, who is a man, monthly falls in love with his wife's mother, who throws ashes in his face. The sun is female; and Mr. Yule[1] (who is my authority) says that the Pleiades are called "the Hen-man" (as in Italy "the chickens"); also that they have names for the twelve months; they do not divide their time by weeks, but hold a market every four days. These people are industrious, and good cultivators of rice, millet, and legumes of many kinds. Potatoes were introduced amongst them about twenty years ago by Mr. Inglis, and they have increased so rapidly that the Calcutta market is now supplied by their produce. They keep bees in rude hives of logs of wood.

The flat table-land on which Churra Poonji is placed, is three miles long and two broad, dipping abruptly in front and on both sides, and rising behind towards the main range, of which it is a spur. The surface of this area is everywhere intersected by shallow, rocky water-courses, which are the natural drains for the deluge that annually visits it. The western part is undulated and hilly, the southern rises in rocky ridges of limestone and coal, and the eastern is very flat and stony, broken only by low isolated conical mounds.

The scenery varies extremely at different parts of the surface. Towards the flat portion, where the English reside, the aspect is as bleak and inhospitable as can be imagined: a thin stratum of marshy or sandy soil covers a tabular mass of cold red sandstone;

[1] I am indebted to Mr. Inglis for most of this information relating to the Khasias, which I have since found, with much more that is curious and interesting, in a paper by Lieut. Yule in Bengal Asiat. Soc. Journal,

and there is not a tree, and scarcely a shrub to be seen, except occasional clumps of *Pandanus*. The low white bungalows are few in number, and very scattered, some of them being a mile asunder, enclosed with stone walls and shrubs; and a small white church, disused on account of the damp, stands lonely in the centre of all.

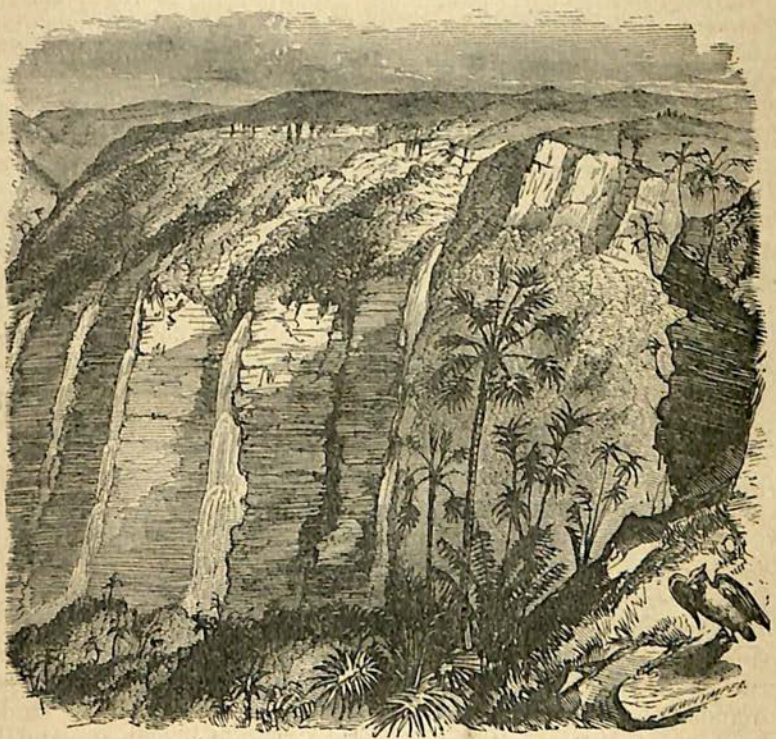
The views from the margins of this plateau are magnificent: 4,000 feet below are bay-like valleys, carpeted as with green velvet, from which rise tall palms, tree-ferns with spreading crowns, and rattans shooting their pointed heads, surrounded with feathery foliage, as with ostrich plumes, far above the great trees. Beyond are the Jheels, looking like a broad shallow sea with the tide half out, bounded in the blue distance by the low hills of Tipperah. To the right and left are scarped red rocks and roaring waterfalls, shooting far over the cliffs, and then arching their necks as they expand in feathery foam, over which rainbows float, forming and dissolving as the wind sways the curtains of spray from side to side.

To the south of Churra the lime and coal measures rise abruptly in flat-topped craggy hills, covered with brushwood and small trees. Similar hills are seen far westward across the intervening valleys in the Garrow country, rising in a series of steep isolated ranges, 300 to 400 feet above the general level of the country, and always skirting the south face of the mountains. Considerable caverns penetrate the limestone, the broken surface of which rock presents many picturesque and beautiful spots, like the same rocks in England.

Westward the plateau becomes very hilly, bare, and grassy, with the streams broad and full, but superficial and rocky, precipitating themselves in low cascades over tabular masses of sand-stone. At Mamloo their beds are deeper, and full of brushwood, and a splendid valley and amphitheatre of red cliffs and cascades, rivalling those of Moosmai (p. 483), bursts suddenly into view. Mamloo is a large village, on the top of a spur, to the westward: it is buried in a small forest, particularly rich in plants, and is defended by a stone wall behind: the only road is tunnelled through the sandstone rock, under the wall; and the spur on either side dips precipitously, so that the place is almost impregnable if properly defended. A sanguinary conflict took place here between the British and the Khasias, which terminated in the latter being driven over the precipices, beneath which many of them were shot. The fan-palm, *Chamærops Khasiana* ("Pakha," Khas.), grows on the cliffs near Mamloo: it may

be seen on looking over the edge of the plateau, its long curved trunk rising out of the naked rocks, but its site is generally inaccessible;[1] while near it grows the *Saxifragis ciliaris* of our English gardens, a common plant in the north-west Himalaya, but extremely scarce in Sikkim and the Khasia mountains.

The descent of the Mamloo spur is by steps, alternating with pebbly flats, for 1,500 feet, to a saddle which connects the Churra hills with those of Lisouplang to the westward. The rise is along



MAMLOO CASCADES.

a very steep narrow ridge to a broad long grassy hill, 3,500 feet high, whence an extremely steep descent leads to the valley of

[1] This species is very closely allied to, if not identical with *C. Martiana* of Nepal, which ascends to 8,000 feet in the western Himalaya, where it is annually covered with snow: it is not found in Sikkim, but an allied species occurs in Affghanistan, called *P. Ritcheana*: the dwarf palm of southern Europe is a fourth species.

the Boga-panee, and the great mart of Chela, which is at the embouchure of that river. The transverse valley thus formed by the Mamloo spur, is full of orange groves, whose brilliant green is particularly conspicuous from above. At the saddle below Mamloo are some jasper rocks, which are the sandstone altered by basalt. Fossil shells are recorded to have been found by Dr. M'Lelland [1] on some of the flats, which he considers to be raised beaches: but we sought in vain for any evidence of this theory beyond the pebbles, whose rounding we attributed to the action of superficial streams.

It is extremely difficult to give within the limits of this narrative any idea of the Khasia flora, which is, in extent and number of fine plants, the richest in India, and probably in all Asia. We collected upwards of 2,000 flowering plants within ten miles of the station of Churra, besides 150 ferns, and a profusion of mosses, lichens, and fungi. This extraordinary exuberance of species is not so much attributable to the elevation, for the whole Sikkim Himalaya (three times more elevated) does not contain 500 more flowering plants, and far fewer ferns, &c.; but to the variety of exposures; namely, 1. the Jheels, 2. the tropical jungles, both in deep, hot, and wet valleys, and on drier slopes; 3. the rocks; 4. the bleak table-lands and stony soils; 5. the moor-like uplands, naked and exposed, where many species and genera appear at 5,000 to 6,000 feet, which are not found on the outer ranges of Sikkim under 10,000.[2] In fact, strange as it may appear, owing to this last cause, the temperate flora descends fully 4,000 feet lower in the latitude of Khasia (25° N.) than in that of Sikkim (27° N.), though the former is two degrees nearer the equator.

The *Pandanus* alone forms a conspicuous feature in the immediate vicinity of Churra; while the small woods about Mamloo, Moosmai, and the coal-pits, are composed of *Symplocos*, laurels, brambles, and jasmines, mixed with small oaks and *Photinia*, and many tropical genera of trees and shrubs.

Orchideæ are, perhaps, the largest natural order in the Khasia, where fully 250 kinds grow, chiefly on trees and rocks, but many are terrestrial, inhabiting damp woods and grassy slopes. I doubt whether in any other part of the globe the species of orchids outnumber those of any other natural order, or form so large a proportion of the flora. Balsams are next in relative abundance

[1] See a paper on the geology of the Khasia mountains by Dr. M'Lelland in the "Bengal Asiatic Society's Journal."

[2] As *Thalictrum*, *Anemone*, primrose, cowslip, *Tofieldia*, Yew, Pine, Saxifrage, *Delphinium Pedicularis*,

(about twenty-five), both tropical and temperate kinds, of great beauty and variety in colour, form, and size of blossom. Palms amount to fourteen, of which the *Chamærops* and *Arenga* are the only genera not found in Sikkim. Of bamboos there are also fifteen, and of other grasses 150, which is an immense proportion, considering that the Indian flora (including those of Ceylon, Kashmir, and all the Himalaya) hardly contains 400. *Scitamineæ* also are abundant, and extremely beautiful; we collected thirty-seven kinds.

No rhododendron grows at Churra, but several species occur a little further north: there is but one pine (*P. Khasiana*) besides the yew, (and two *Podocarpi*), and that is only found in the drier interior regions. Singular to say, it is a species not seen in the Himalaya or elsewhere, but very nearly allied to *Pinus longifolia*,[1] though more closely resembling the Scotch fir than that tree does.

The natural orders whose rarity is most noticeable, are *Cruciferæ*, represented by only three kinds, and *Caryophylleæ*. Of *Ranunculaceæ*, there are six or seven species of *Clematis*, two of *Anemone*, one *Delphinium*, three of *Thalictrum*, and two *Ranunculi*. *Compositæ* and *Leguminosæ* are far more numerous than in Sikkim.

The climate of Khasia is remarkable for the excessive rain-fall. Attention was first drawn to this by Mr. Yule, who stated, that in the month of August, 1841, 264 inches fell, or twenty-two feet; and that during five successive days, thirty inches fell in every twenty-four hours! Dr. Thomson and I also recorded thirty inches in one day and night, and during the seven months of our stay, upwards of 500 inches fell, so that the total annual fall perhaps greatly exceeded 600 inches, or fifty feet, which has been registered in succeeding years! From April, 1849, to April, 1850, 502 inches (forty-two feet) fell. This unparalleled amount is attributable to the abruptness of the mountains which face the Bay of Bengal, from which they are separated by 200 miles of Jheels and Sunderbunds.

[1] Cone-bearing pines with long leaves, like the common Scotch fir, are found in Asia, and as far south as the Equator (in Borneo), and also inhabit Arracan, the Malay Peninsula, Sumatra, and South China. It is a very remarkable fact that no Gymnospermous tree inhabits the Peninsula of India; not even the genus *Podocarpus*, which includes most of the tropical Gymnosperms, and is technically coniferous, and has glandular woody fibre; though like the yew it bears berries. Two species of this genus are found in the Khasia, and one advances as far west as Nepal. The absence of oaks and of the above genera (*Podocarpus* and *Pinus*) is one of the most characteristic differences between the botany of the east and west shores of the Bay of Bengal.

This fall is very local: at Silhet, not thirty miles further south, it is under 100 inches; at Gowahatty, north of the Khasia in Assam, it is about 80: and even on the hills, twenty miles inland from Churra itself, the fall is reduced to 200. At the Churra station, the distribution of the rain is very local; my gauges, though registering the same amount when placed beside a good one in the station; when removed half a mile, received a widely different quantity, though the different gauges gave nearly the same mean amount at the end of each whole month.

The direct effect of this deluge is to raise the little streams about Churra fourteen feet in as many hours, and to inundate the whole flat; from which, however, the natural drainage is so complete, as to render a tract, which in such a climate and latitude should be clothed with exuberant forest, so sterile, that no tree finds support, and there is no soil for cultivation of any kind whatsoever, not even of rice. Owing, however, to the hardness of the horizontally stratified sandstone, the streams have not cut deep channels, nor have the cataracts worked far back into the cliffs. The limestone alone seems to suffer, and the turbid streams from it prove how rapidly it is becoming denuded. The great mounds of angular gravel on the Churra flat are perhaps the remains of an extensive deposit, fifty feet thick, elsewhere washed away by these rains; and I have remarked traces of the same over many slopes of the hills around.

The mean temperature of Churra (elev. 4,000 feet) is about 66°, or 16° below that of Calcutta; which, allowing for 2½° of northing, gives 1° of temperature to every 290 to 300 feet of ascent. In summer the thermometer often rises to 88° and 90°; and in the winter, owing to the intense radiation, hoar-frost is frequent. Such a climate is no less inimical to the cultivation of plants, than is the wretched soil: of this we saw marked instances in the gardens of two of the resident officers, Lieutenants Raban and Cave, to whom we were indebted for the greatest kindness and hospitality. These gentlemen are indefatigable horticulturists, and took a zealous interest in our pursuits, accompanying us in our excursions, enriching our collections in many ways, and keeping an eye to them and to our plant-driers during our absence from the station. In their gardens the soil had to be brought from a considerable distance, and dressed copiously with vegetable matter. Bamboo clumps were planted for shelter within walls, and native shrubs, rhododendrons, &c., introduced. Many *Orchideæ* throve well on the branches of the stunted trees which they had planted, and some superb kinds of *Hedychium* in the ground;

but a very few English garden plants throve in the flower-beds. Even in pots and frames, geraniums, &c., would rot, from the rarity of sunshine, which is as prejudicial as the damp and exposure. Still many wild shrubs of great interest and beauty flourished, and some European ones succeeded with skill and management; as geraniums, *Salvia*, *Petunia*, nasturtium, chrysanthemum, *Kennedya rubicunda*, *Maurandya*, and Fuschia. The daisy seed sent from England as double, came up very poor and single. Dahlias do not thrive, nor double balsams. Now they have erected small but airy green-houses, and sunlight is the only desideratum.

At the end of June, we started on foot for the northern or Assam face of the hills. The road runs between the extensive and populous native village, or poonji, on the left, and a deep valley on the right, and commands a beautiful view of more waterfalls. Beyond this it ascends steeply, and the sandstone on the road itself is curiously divided into parallelograms, like hollow bricks,[1] enclosing irregularly shaped nodules, while in other places it looks as if it had been run or fused: spherical concretions of sand, coloured concentrically by infiltration, are common in it, which have been regarded as seeds, shells, &c.; it also contained spheres of iron pyrites. The general appearance of much of this rock is as if it had been bored by *Teredines* (ship worms), but I never detected any trace of fossils. It is often beautifully ripple-marked, and in some places much honeycombed, and full of shales and narrow seams of coal, resting on a white under-clay full of root-fibres, like those of *Stigmaria*.

At about 5,000 feet the country is very open and bare, the ridges being so uniform and flat-topped, that the broad valleys they divide are hidden till their precipitous edges are reached; and the eye wanders far east and west over a desolate level grassy country, unbroken, save by the curious flat-topped hills I have described as belonging to the limestone formation, which lie to the south-west. These features continue for eight miles, when a sudden descent of 600 to 700 feet leads into the valley of the Kala-panee (Black water) river, where there is a low dark and damp bungalow, which proved a very great accommodation for us.[2]

[1] I have seen similar bricks in the sandstones of the coal-districts of Yorkshire; they are very puzzling, and are probably due to some very obscure crystalline action analogous to jointing and cleavage.

[2] It may be of use to the future botanist in this country to mention a small wood on the right of this road, near the village of Surureem, as an excellent

Lailang-kot is another village full of iron forges, from a height near which a splendid view is obtained over the Churra flat. A few old and very stunted shrubs of laurel and *Symplocos* grow on its bleak surface, and these are often sunk from one to three feet in a well in the horizontally stratified sandstone. I could only account for this by supposing it to arise from the drip from the trees, and if so, it is a wonderful instance of the wearing effects of water, and of the great age which small bushes sometimes attain.

The vegetation is more alpine at Kala-panee (elevation, 5,000 feet); *Benthamia*, *Kadsura*, *Stauntonia*, *Illicium*, *Actinidia*, *Helwingia*, *Corylopsis*, and berberry—all Japan and Chinese, and most of them Darjeeling genera—appear here, with the English yew, two rhododendrons, and *Bucklandia*. There are no large trees, but a bright green jungle of small ones and bushes, many of which are very rare and curious. *Luculia Pinceana* makes a gorgeous show here in October.

The sandstone to the east of Kala-panee is capped by some beds, forty feet thick, of conglomerate worn into cliffs; these are the remains of a very extensive horizontally stratified formation, now all but entirely denuded. In the valley itself, the sandstone alternates with alum shales, which rest on a bed of quartz conglomerate, and the latter on black greenstone. In the bed of the river, whose waters are beautifully clear, are hornstone rocks, dipping north-east, and striking north-west. Beyond the Kala-panee the road ascends about 600 feet, and is well quarried in hard greenstone; and passing through a narrow gap of conglomerate rock,[1] enters a shallow, wild, and beautiful valley, through which it runs for several miles. The hills on either side are of greenstone capped by tabular sandstone, immense masses of which have been precipitated on the floor of the valley, producing a singularly wild and picturesque scene. In the gloom of the evening it is not difficult for a fertile imagination to fancy castles and cities cresting the heights above.[2]

botanical station: the trees are chiefly *Rhododendron arboreum*, figs, oaks, laurels, magnolias, and chesnuts, on whose limbs are a profusion of *Orchideæ*, and amongst which a Rattan palm occurs.

[1] Formed of rolled masses of greenstone and sandstone, united by a white and yellow cement.

[2] *Hydrangea* grows here, with ivy, *Mussænda*, *Pyrus*, willow, *Viburnum*, *Parnassia*, *Anemone*, *Leycesteria formosa*, *Neillia*, *Rubus*, *Astilbe*, rose, *Panax*, apple, *Bucklandia*, *Daphne*, pepper, *Scindapsus*, *Pieris*, holly, *Lilium giganteum* ("Kalang tatti," Khas.), *Camellia*, *Elæocarpus*, *Buddleia*, &c. Large bees' nests hang from the rocks.

There is some cultivation here of potatos, and of *Rhyncosia vestita*, a beautiful purple-flowered leguminous plant, with small tuberous roots. Beyond this, a high ridge is gained above the valley of the Boga-panee, the largest river in the Khasia; from this the Bhotan Himalaya may be seen in clear weather, at the astonishing distance of from 160 to 200 miles! The vegetation here suddenly assumes a different aspect, from the quantity of stunted fir-trees clothing the north side of the valley, which rises very steeply 1,000 feet above the river: quite unaccountably, however, not one grows on the south face. A new oak also appears abundantly; it has leaves like the English, whose gnarled habit it also assumes.

The descent is very steep, and carried down a slope of greenstone;[1] the road then follows a clear affluent of the Boga-panee, and afterwards winds along the margin of that river, which is a rapid turbulent stream, very muddy, and hence contrasting remarkably with the Kala-panee. It derives its mud from the decomposition of granite, which is washed by the natives for iron, and in which rock it rises to the eastward. Thick beds of slate crop out by the roadside (strike north-east and dip north-west), and are continued along the bed of the river, passing into conglomerates, chert, purple slates, and crystalline sandstones, with pebbles, and angular masses of schist. Many of these rocks are much crumpled, others quite flat, and they are overlaid by soft, variegated gneiss, which is continued alternately with the slates to the top of the hills on the opposite side.

Small trees of hornbeam grow near the river with *Rhus*, *Xanthoxylon*, *Vaccinium*, *Gualtheria*, and *Spiræa*, while many beautiful ferns, mosses, and orchids cover the rocks. An elegant iron suspension-bridge is thrown across the stream, from a rock matted with tufts of little parasitic *Orchideæ*. Crossing it, we came on many pine-trees; these had five-years' old cones on them, as well as those of all succeeding years; they bear male flowers in autumn, which impregnate the cones formed the previous year.

[1] This greenstone decomposes into a thick bed of red clay; it is much intersected by fissures or cleavage planes at all angles, whose surfaces are covered with a shining polished superficial layer; like the fissures in the cleavage planes of the gneiss granite of Kinchinjhow, whose adjacent surfaces are coated with a glassy waved layer of hornblende. This polishing of the surfaces is generally attributed to their having been in contact and rubbed together, an explanation which is wholly unsatisfactory to me; no such motion could take place in cleavage planes which often intersect, and were it to occur, it would not produce two polished surfaces of an interposed layer of a softer mineral. It is more probably due to metamorphic action.

Thus, the cones formed in the spring of 1850 are fertilised in the following autumn, and do not ripen their seeds till the second following autumn, that of 1852.

A very steep ascent leads to the bungalow of Moflong, on a broad, bleak hill-top, near the axis of the range (alt. 6,062 feet). Here there is a village, and some cultivation, surrounded by hedges of *Erythrina*, *Pieris*, *Viburnum*, *Pyrus*, *Colquhounia*, and *Corylopsis*, amongst which grew an autumn-flowering larkspur, with most fœtid flowers.[1] The rocks are much contorted slates and gneiss (strike north-east and dip south-east). In a deep gulley to the northward, greenstone appears, with black basalt and jasper, the latter apparently altered gneiss: beyond this the rocks strike the opposite way, but are much disturbed.

We passed the end of June here, and experienced the same violent weather, thunder, lightning, gales, and rain, which prevailed during every midsummer I spent in India. A great deal of *Coix* (Job's tears) is cultivated about Moflong: it is of a dull greenish purple, and though planted in drills, and carefully hoed and weeded, is a very ragged crop. The shell of the cultivated sort is soft, and the kernel is sweet; whereas the wild *Coix* is so hard that it cannot be broken by the teeth. Each plant branches two or three times from the base, and from seven to nine plants grow in each square yard of soil: the produce is small, not above thirty or forty fold.

From a hill behind Moflong bungalow, on which are some stone altars, a most superb view is obtained of the Bhotan Himalaya to the northward, their snowy peaks stretching in a broken series from north 17° east to north 35° west; all are below the horizon of the spectator, though from 17,000 to 20,000 feet above his level. The finest view in the Khasia mountains, and perhaps a more extensive one than has ever before been described, is that from Shillong hill, the culminant point of the range, about six miles north-east from Moflong bungalow. This hill, 6,660 feet above the sea, rises from an undulating grassy country, covered with scattered trees and occasional clumps of wood; the whole scenery about being park-like, and as little like that of India at so low an elevation as it is possible to be.

[1] There is a wood a mile to the west of the bungalow, worth visiting by the botanist: besides yew, oak, *Sabia* and *Camellia*, it contains *Olea*, *Euonymus*, and *Sphærocarya*, a small tree that bears a green pear-shaped sweet fruit, with a large stone: it is pleasant, but leaves a disagreeable taste in the mouth. On the grassy flats an *Astragalus* occurs, and *Roscoea purpurea* *Tofieldia*, and various other fine plants are common.

I visited Shillong in October with Lieutenant Cave; starting from Churra, and reaching the bungalow, two miles from its top, the same night, with two relays of ponies, which he had kindly provided. We were unfortunate in not obtaining a brilliant view of the snowy mountains, their tops being partially clouded; but the *coup d'œil* was superb. Northward, beyond the rolling Khasia hills, lay the whole Assam valley, seventy miles broad, with the Burrampooter winding through it, fifty miles distant, reduced to a thread. Beyond this, banks of hazy vapour obscured all but the dark range of the Lower Himalaya, crested by peaks of frosted silver, at the immense distance of from 100 to 220 miles from Shillong. All are below the horizon of the observer; yet so false is perspective, that they seem high in the air. The mountains occupy sixty degrees of the horizon, and stretch over upwards of 250 miles, comprising the greatest extent of snow visible from any point with which I am acquainted.

Westward from Shillong the most distant Garrow hills visible are about forty miles off; and eastward those of Cachar, which are loftier, are about seventy miles. To the south the view is limited by the Tipperah hills, which, where nearest, are 100 miles distant; while to the south-west lies the sea-like Gangetic delta, whose horizon, lifted by refraction, must be fully 120. The extent of this view is therefore upwards of 340 miles in one direction, and the visible horizon of the observer encircles an area of fully thirty thousand square miles, which is greater than that of Ireland!

Scarlet-flowered rhododendron bushes cover the north side of Shillong,[1] whilst the south is grassy and quite bare; and except some good *Orchideæ* on the trees, there is little to reward the botanist. The rocks appeared to be sandstone at the summit, but micaceous gneiss all around.

Continuing northward from Moflong, the road, after five miles, dips into a very broad and shallow flat-floored valley, fully a mile across, which resembles a lake-bed: it is bounded by low hills, and is called "Lanten-tannia," and is bare of aught but long grass and herbs; amongst these are the large groundsel (*Senecio*), *Dipsacus*, *Ophelia*, and *Campanula*. On its south flank the micaceous slates strike north-east, and dip north-west, and on the top repose beds, a foot in thickness, of angular waterworn gravel, indicating an ancient water-level, 400 feet above the floor of the

[1] These skirt a wood of prickly bamboo, in which occur fig, laurel, *Aralia*, *Bœhmeria*, *Smilax*, *Toddalia*, wild cinnamon, and three kinds of oak.

valley. Other smaller lake-beds, in the lateral valleys, are equally evident.

A beautiful blue-flowered *Clitoria* creeps over the path, with the ground-raspberry of Darjeeling. From the top a sudden descent of 400 feet leads to another broad flat valley, called "Syong" (elevation, 5,725 feet), in which is a good bungalow, surrounded by hedges of *Prinsepia utilis*, a common north-west Himalayan plant, only found at 8,000 feet in Sikkim. The valley is grassy, but otherwise bare. Beyond this the road passes over low rocky hills, wooded on their north or sheltered flanks only, dividing flat-floored valleys: a red sandy gneiss is the prevalent rock, but boulders of syenite are scattered about. Extensive moors (elevation, 6,000 feet) succeed, covered with stunted pines, brake, and tufts of harsh grasses.[1]

Near the Dengship-oong (river), which flows in a narrow valley, is a low dome of gneiss altered by syenite. The prevalent dip is uniformly south-east, and the strike north-east; and detached boulders of syenite become more frequent, resting on a red gneiss, full of black garnets, till the descent to the valley of Myrung, one of the most beautiful spots in the Khasia, and a favourite resort, having an excellent bungalow which commands a superb view of the Himalaya: it is 5,650 feet above the sea, and is placed on the north flank of a very shallow marshy valley, two miles broad, and full of rice cultivation, as are the flat heads of all the little valleys that lead into it. There is a guard here of light infantry, and a little garden, boasting a gardener and some tea-plants, so that we had vegetables during our four visits to the place, on two of which occasions we stayed some days.

From Kala-panee to Myrung, a distance of thirty-two miles, the road does not vary 500 feet above or below the mean level of 5,700 feet, and the physical features are the same throughout, of broad flat-floored, steep-sided valleys, divided by bleak, grassy, tolerably level-topped hills. Beyond Myrung the Khasia mountains slope to the southward in rolling loosely-wooded hills, but the spurs do not dip suddenly till beyond Nunklow, eight miles further north.

On the south side of the Myrung valley is Nungbree wood, a dense jungle, occupying, like all the other woods, the steep north

[1] These are principally *Andropogon* and *Brachypodium*, amongst which grow yellow *Corydalis*, *Thalictrum*, *Anemone*, *Parnassia*, *Prunella*, strawberry, *Eupatorium*, *Hypericum*, willow, a *Polygonum* like *Bistorta*, *Osmunda regalis* and another species, *Lycopodium alpinum*, a *Senecio* like *Jacobæa*, thistles, *Gnaphalium*, Gentians, *Iris*, *Paris*, *Sanguisorba* and *Agrimonia*.

exposure of the hill; many good plants grow in it, including some gigantic *Balanophoræ*, *Pyrola*, and *Monotropa*. The bungalow stands on soft, contorted, decomposing gneiss, which is still the prevalent rock, striking north-east. On the hills to the east of it, enormous hard blocks lie fully exposed, and are piled on one another, as if so disposed by glacial action; and it is difficult to account for them by denudation, though their surface scales, and similar blocks are scattered around Myrung exactly similar to the syenite blocks of Nunklow, and the granite ones of Nonkreem, to be described hereafter, and which are undoubtedly due to the process of weathering. A great mass of flesh-coloured crystalline granite rises in the centre of the valley, to the east of the road: it is fissured in various directions, and the surface scales concentrically; it is obscurely stratified in some parts, and appears to be half granite and half gneiss in mineralogical character.

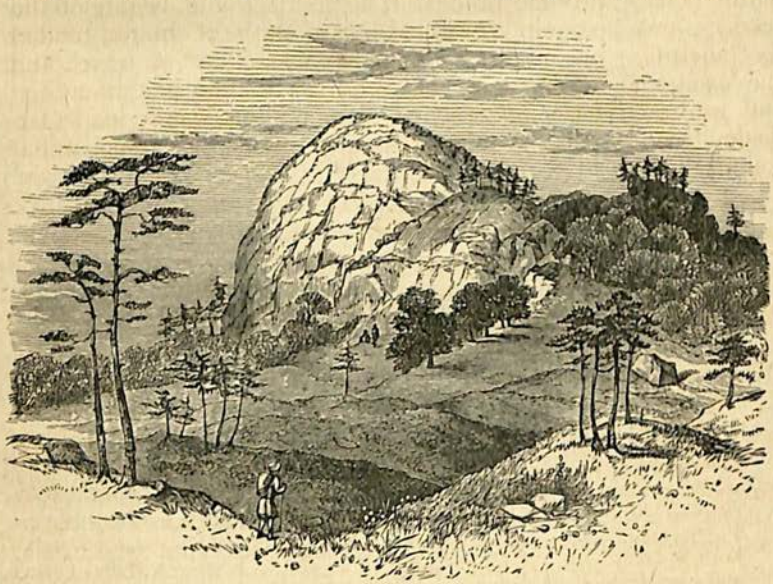
We twice visited a very remarkable hill, called Kollong, which rises as a dome of granite 5,400 feet high, ten or twelve miles south-west of Myrung, and conspicuous from all directions. The path to it turns off from that to Nunklow, and strikes westerly along the shallow valley of Monai, in which is a village, and much rice and other cultivation. Near this there is a large square stockade, formed of tall bamboos placed close together, very like a New Zealand "Pa;" indeed, the whole country hereabouts much recalls the grassy clay hills, marshy valleys, and bushy ridges of the Bay of Islands.

The hills on either side are sometimes dotted with pine-woods, sometimes conical and bare, with small clumps of pines on the summit only; while in other places are broad tracts containing nothing but young trees, resembling plantations, but which, I am assured, are not planted; on the other hand, however, Mr. Yule states, that the natives do plant fir-trees, especially near the iron forges, which give employment to all the people of Monai.

All the streams rise in flat marshy depressions amongst the hills with which the whole country is covered; and both these features, together with the flat clay marshes into which the rivers expand, are very suggestive of tidal action. Rock is hardly anywhere seen, except in the immediate vicinity of Kollong, where are many scattered boulders of fine-grained gneiss, of which are made the broad stone slabs, placed as seats, and the other erections of this singular people. We repeatedly remarked cones of earth, clay, and pebbles, about twelve feet high, upon the hills, which appeared to be artificial, but of which the natives could give no explanation. Wild apple and birch are common trees, but there

is little jungle, except in the hollows, and on the north slopes of the higher hills. Coarse long grass, with bushes of Labiate and Composite plants, are the prevalent features.

Kollong rock is a steep dome of red granite,[1] accessible from the north and east, but almost perpendicular to the southward, where the slope is 80° for 600 feet. The elevation is 400 feet above the mean level of the surrounding ridges, and 700 feet above the bottom of the valleys. The south or steepest side is encumbered with enormous detached blocks, while the north is



KOLLONG ROCK.

clothed with a dense forest, containing red tree-rhododendrons and oaks; on its skirts grew a white bushy rhododendron, which we found nowhere else. The hard granite of the top was covered with matted mosses, lichens, Lycopodiums, and ferns, amongst which were many curious and beautiful air-plants.[2]

[1] This granite is highly crystalline, and does not scale or flake, nor is its surface polished.

[2] *Eria*, *Cœlogyne* (*Wallichii*, *maculata*, and *elata*), *Cymbidium*, *Dendrobium*, *Sunipia*, some of them flowering profusely; and though freely exposed to the sun and wind, dews and frosts, rain and droughts, they were all fresh, bright, green, and strong, under very different treatment from that to which they are exposed in the damp, unhealthy, steamy orchid-houses of our English gardens.

The view from the top is very extensive to the northward, but not elsewhere: it commands the Assam valley and the Himalaya, and the billowy range of undulating grassy Khasia mountains. Few houses were visible, but the curling smoke from the valleys betrayed their lurking-places, whilst the tinkling sound of the hammers from the distant forges on all sides was singularly musical and pleasing; they fell on the ear like "bells upon the wind," each ring being exquisitely melodious, and chiming harmoniously with the others. The solitude and beauty of the scenery, and the emotions excited by the music of chimes, tended to tranquillise our minds, wearied by the fatigues of travel, and the excitement of pursuits that required unremitting attention; and we rested for some time, our imaginations wandering to far-distant scenes, brought vividly to our minds by these familiar sounds.

CHAPTER XXX.

View of Himalaya from the Khasia—Great masses of snow—Chumulari—Donkia—Grasses—Nunklow—Assam valley and Burrampooter—Tropical forest—Bor-panee—Rhododendrons—Wild elephants—Blocks of Syenite Return to Churra—Coal—August temperature—Leave for Chela—Jasper hill—Birds—*Arundina*—Habits of leaf-insects—Curious village—Houses—Canoes—Boga-panee river—Jheels—Chattuc—Churra—Leave for Jyntea hills—Trading parties—Dried fish—Cherries—Cinnamon—Fraud—Pea-violet—Nonkreem—Sandstone—Pines—Granite boulders—Iron washing—Forges—Tanks—Siberian *Nymphæa*—Barren country—Pomrang—*Podostemon*—Patchouli plant—Mooshye—Enormous stone slabs—Pitcher-plant—Joowye cultivation and vegetation—*Hydropeltis*—Sulky hostess—Nurtiung—*Hamamelis chinensis*—Bor-panee river—Sacred grove and gigantic stone structures—Altars—Pyramids, &c.—Origin of names—*Vanda cærulea*—Collections—November vegetation—Geology of Khasia—Sandstone—Coal—Lime—Gneiss—Greenstone—Tidal action—Strike of rocks—Comparison with Rajmahal hills and the Himalaya.

THE snowy Himalaya was not visible during our first stay at Myrung, from the 5th to the 10th of July; but on three subsequent occasions, viz., 27th and 28th of July, 13th to 17th October, and 22nd to 25th October, we saw these magnificent mountains, and repeatedly took angular heights and bearings of the

A wild onion was most abundant all over the top of the hill, with *Hymenopogon*, *Vaccinium*, *Ophiopogon*, *Anisadenia*, *Commelyna*, *Didymocarpus*, *Remusatia*, *Hedychium*, grass and small bamboos, and a good many other plants. Many of the lichens were of European kinds; but the mosses (except *Bryum argenteum*) and ferns were different. A small *Staphylinus*, which swarmed under the sods, was the only insect I remarked.

principal peaks. The range, as seen from the Khasia, does not form a continuous line of snowy mountains, but the loftiest eminences are conspicuously grouped into masses, whose position is probably between the great rivers which rise far beyond them and flow through Bhotan. This arrangement indicates that relation of the rivers to the masses of snow, which I have dwelt upon in the Appendix; and further tends to prove that the snowy mountains, seen from the southward, are not on the axis of a mountain chain, and do not even indicate its position; but that they are lofty meridional spurs which, projecting southward, catch the moist vapours, become more deeply snowed, and protect the dry loftier regions behind.

The most conspicuous group of snows seen from the Khasia bears N.N.E. from Myrung, and consists of three beautiful mountains with wide-spreading snowy shoulders. These are distant (reckoning from west to east) respectively 164, 170, and 172 miles from Myrung, and subtend angles of + 0° 4′ 0″,—0° 1′ 30″, and —0° 2′ 28″.[1] From Nunklow (940 feet lower than Myrung) they appear higher, the western peak rising 14′ 35″ above the horizon; whilst from Moflong (32 miles further south, and elevation 6,062 feet) the same is sunk 2′ below the horizon. My computations make this western mountain upwards of 24,000 feet high; but according to Col. Wilcox's angles, taken from the Assam valley, it is only 21,600, the others being respectively 20,720, and 21,475. Captain Thuillier (the Deputy Surveyor General) agrees with me in considering that Colonel Wilcox's altitudes are probably much under-estimated, as those of other Himalayan peaks to the westward were by the old surveyors. It is further evident that these mountains have (as far as can be estimated by angles) fully 68,000 feet of snow on them, which would not be the case were the loftiest only 21,600 feet high.

[1] These angles were taken both at sunrise and sunset, and with an excellent theodolite, and were repeated after two considerable intervals. The telescopes were reversed after each observation; and every precaution used to insure accuracy; nevertheless the mean of one set of observations of angular height often varied 1′ from that of another set. This is probably much due to atmospheric refraction, whose effect and amount it is impossible to estimate accurately in such cases. Here the objects are not only viewed through 160 miles of atmosphere, but through belts from between 6,000 to 20,000 feet of vertical height, varying in humidity and transparency at different parts of the interval. If we divide this column of atmosphere into sections parallel to those of latitude, we have first a belt fifteen miles broad, hanging over the Khasia, 2,000 to 4,000 feet above the sea; beyond it, a second belt, twenty miles broad, hangs over the Assam valley, which is hardly 300 feet above the level of the sea; and thirdly, the northern part of the column, which reposes on 60 to 100 miles of the Bhotan lower Himalaya: each of these belts has probably a different refractive power.

It is singular, that to the eastward of this group, no snowy mountains are seen, and the lower Himalaya also dip suddenly. This depression is no doubt partly due to perspective; but as there is no such sudden disappearance of the chain to the westward, where peaks are seen 35° to the west of the north, it is far more probable that the valley of the Soobansiri river, which rises in Tibet far behind these peaks, is broad and open; as is that of the Dihong, still farther east, and which I have every reason to believe is the Tibetan Yaru or Burrampooter.

Supposing then the eastern group to indicate the mountain mass separating the Soobansiri from the Monass river, no other mountains conspicuous for altitude or dimension rise between N.N.E. and north, where there is another immense group. This, though within 120 miles of Myrung, is below its horizon, and scarcely above that of Nunklow (which is still nearer to it), and cannot therefore attain any great elevation.

Far to the westward again, is a very lofty peaked mountain bearing N.N.W., which subtends an angle of —3′30″ from Myrung, and + 6′ 0″ from Nunklow. The angles of this seem to indicate its being either Chumulari, or that great peak which I saw due east from Bhomtso top, and which I then estimated at ninety miles off and 23,500 feet high. From the Khasia angles, its latitude and longitude are 28° 6′ and 89° 30′, its elevation 27,000 feet, and its distance from Myrung 200 miles. I need hardly add that neither the position nor the elevation computed from such data is worthy of confidence.

Further still, to the extreme west, is an immense low hog-backed mass of snow, with a small peak on it; this bears north-west, both from Myrung and Nunklow, subtending an angle of —25′ from the former, and —17′ from the latter station. It is in all probability Chumulari, 210 miles distant from Nunklow. Donkia, if seen, would be distant 230 miles from the same spot in the Khasia, and Kinchinjunga 260; possibly they are visible (by refraction) from Shillong, though even further from it.

The distance from Myrung to Nunklow is ten miles, along an excellent road. The descent is at first sudden, beyond which the country is undulating, interspersed with jungle (of low trees, chiefly oaks) and marshes, with much rice cultivation. Grasses are exceedingly numerous; we gathered fifty kinds, besides twenty *Cyperaceæ*: four were cultivated, namely sugar-cane, rice, *Coix*, and maize. Most of the others were not so well suited to pasturage as those of higher localities. Dwarf Phœnix palm occurs by the roadside at 5,000 feet elevation.

Gneiss (with garnets) highly inclined, was the prevalent rock (striking north-east), and scattered boulders of syenite became very frequent. In one place the latter rock is seen bursting through the gneiss, which is slaty and very crystalline at the junction.

Nunklow is placed at the northern extremity of a broad spur that overhangs the valley of the Burrampooter river, thirty miles distant. The descent from it is very rapid, and beyond it none of the many spurs thrown out by the Khasia attain more than 1,000 feet elevation; hence, though the range does not present so abrupt a face to the Burrampooter as it does to the Jheels, Nunklow is considered as on the brink of its north slope. The elevation of the bungalow is 4,688 feet, and the climate being hot, it swarms with mosquitos, fleas, and rats. It commands a superb view to the north, of the Himalayan snows, of the Burrampooter, and intervening malarious Terai forest; and to the south, of the undulating Khasia, with Kollong rock bearing south-west. All the hills between this and Myrung look from Nunklow better wooded than they do from Myrung, in consequence of the slopes exposed to the south being bare of forest.

A thousand feet below the bungalow, a tropical forest begins, of figs, birch, horse-chesnut, oak, nutmeg, *Cedrela*, *Engelhardtia*, *Artrocarpeæ*, and *Elæocarpus*, in the gullies, and tall pines on the dry slopes, which are continued down to the very bottom of the valley in which flows the Bor-panee, a broad and rapid river that descends from Shillong, and winds round the base of the Nunklow spur. Many of the pines are eighty feet high, and three or four in diameter, but none form gigantic trees. The quantity of balsams in the wet ravines is very great, and tree-ferns of several kinds are common.

The Bor-panee is about forty yards wide, and is spanned by an elegant iron suspension-bridge, that is clamped to the gneiss rock (strike north-east, dip north-west) on either bank; beneath is a series of cascades, none high, but all of great beauty from the broken masses of rocks and picturesque scenery on either side. We frequently botanised up and down the river with great success: many curious plants grow on its stony and rocky banks, and amongst them *Rhododendron formosum* at the low elevation of 2,000 feet. A most splendid fern, *Dipteris Wallichii*, is abundant, with the dwarf Phœnix palm and *Cycas pectinata*.

Wild animals are very abundant here, though extremely rare on the higher part of the Khasia range; tigers, however, and bears ascend to Nunklow. We saw troops of wild dogs ("Kuleam,"

Khas.), deer, and immense quantities of the droppings of the wild elephant; an animal considered in Assam dangerous to meet, whereas in other parts of India it is not dreaded till provoked. There is, however, no quadruped that varies more in its native state than this: the Ceylon kind differs from the Indian in the larger size and short tusks, and an experienced judge at Calcutta will tell at once whether the newly caught elephant is from Assam, Silhet, Cuttack, Nepal, or Chittagong. Some of the differences, in size, roundness of shoulders and back, quantity of hair, length of limb, and shape of head, are very marked; and their dispositions are equally various.

The lowest rocks seen are at a considerable distance down the Bor-panee; they are friable sandstones that strike uniformly with the gneiss. From the bridge upwards the rocks are all gneiss, alternating with chert and quartz. The Nunklow spur is covered with enormous rounded blocks of syenite, reposing on clay or on one another. These do not descend the hill, and are the remains of an extensive formation which we could only find *in situ* at one spot on the road to Myrung (see p. 503), but which must have been of immense thickness.[1] One block within ten yards of the bungalow door was fifteen feet long, six high, and eight broad; it appeared half buried, and was rapidly decomposing from the action of the rain. Close by, to the westward, in walking amongst the masses we were reminded of a moraine of most gigantic sized blocks; one which I measured was forty feet long and eleven above the ground; its edges were rounded, and its surface flaked off in pieces a foot broad and a quarter of an inch thick. Trees and brushwood often conceal the spaces between these fragments, and afford dens for bears and leopards, into which man cannot follow them.

Sitting in the cool evenings on one of these great blocks, and watching the Himalayan glaciers glowing with the rays of sunset, appearing to change in form and dimensions with the falling shadows, it was impossible to refrain from speculating on the possibility of these great boulders heaped on the Himalayan-ward face of the Khasia range, having been transported hither by ice at some former period; especially as the Mont Blanc granite, in crossing the Lake of Geneva to the Jura, must have performed a hardly less wonderful ice journey: but this hypothesis is clearly

[1] The tendency of many volcanic rocks to decompose in spheres is very well known: it is conspicuous in the black basalts north of Edinburgh, but I do not know any instance equal to this of Nunklow, for the extent of decomposition and dimensions of the resulting spheres.

untenable; and unparalleled in our experience as the results appear, if attributed to denudation and weathering alone, we are yet compelled to refer them to these causes. The further we travel, and the longer we study, the more positive becomes the conviction that the part played by these great agents in sculpturing the surface of our planet, is as yet but half recognised.

We returned on the 7th of August to Churra, where we employed ourselves during the rest of the month in collecting and studying the plants of the neighbourhood. We hired a large and good bungalow, in which three immense coal fires [1] were kept up for drying plants and papers, and fifteen men were always employed, some in changing, and some in collecting, from morning till night. The coal was procured within a mile of our door, and cost about six shillings a month; it was of the finest quality, and gave great heat and few ashes. Torrents of rain descended almost daily, twelve inches in as many hours being frequently registered; and we remarked that it was impossible to judge of the quantity by estimation, an apparent deluge sometimes proving much less in amount than much lighter but steadier falls; hence the greatest fall is probably that in which the drops are moderately large, very close together, and which pass through a saturated atmosphere. The temperature of the rain here and elsewhere in India was always a degree or two below that of the air.

Though the temperature in August rose to 75°, we never felt a fire oppressive, owing to the constant damp, and absence of sun. The latter, when it broke through the clouds, shone powerfully, raising the thermometer 20° and 30° in as many minutes. On such occasions, hot blasts of damp wind ascend the valleys, and impinge suddenly against different houses on the flat, giving rise to extraordinary differences between the mean daily temperatures of places not half a mile apart.

On the 4th of September we started for the village of Chela, which lies west from Churra, at the embouchure of the Boga-panee on the Jheels. The path runs by Mamloo, and down the spur to the Jasper hill (see p. 489): the vegetation all along is very tropical, and pepper, ginger, maize, and Betel palm, are cultivated around small cottages, which are only distinguishable in the forest by their yellow thatch of dry *Calamus* (Rattan) leaves. From

[1] This coal is excellent for many purposes. We found it generally used by the Assam steamers, and were informed on board that in which we traversed the Sunderbunds, some months afterwards, that her furnaces consumed 729 lbs. per hour; whereas the consumption of English coal was 800 lbs., of Burdwan coal 840 lbs., and of Assam 900 lbs.

Jasper hill a very steep ridge leads to another, Lisouplang, which is hardly so high as Mamloo; the rocks are the same sandstone, with fragments of coal, and remains of the limestone formation capping it.

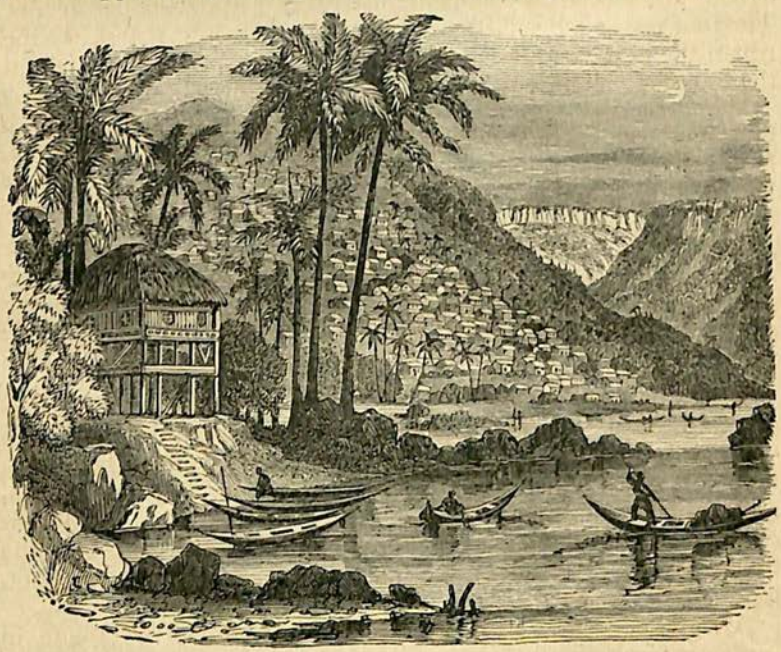
Hot gusts of wind blow up the valleys, alternating with clouds and mists, and it is curious to watch the effects of the latter in stilling the voices of insects (Cicadas) and birds. Common crows and vultures haunt the villages, but these, and all other large birds, are very rare in the Khasia. A very few hawks are occasionally seen, also sparrows and kingfishers, and I once heard a cuckoo; pheasants are sometimes shot, but we never saw any. Kites become numerous after the rains, and are regarded as a sign of their cessation. More remarkable than the rarity of birds is the absence of all animals except domestic rats, as a more suitable country for hares and rabbits could not be found. Reptiles, and especially Colubridæ, are very common in the Khasia mountains, and I procured sixteen species and many specimens. The natives repeatedly assured us that these were all harmless, and Dr. Gray, who has kindly examined all my snakes, informs me of the remarkable fact (alluded to in a note to p. 306), that whereas none of these are poisonous, five of the eleven species which I found in Sikkim are so. One of the Khasia blind-worms (a new species) belongs to a truly American genus (*Ophisaurus*), a fact as important as is that of the Sikkim skink and *Agama* being also American forms.

Arundina, a beautiful purple grassy-leaved orchid, was abundantly in flower on the hill-top, and the great white swallow-tailed moth (*Saturnia Atlas*) was extremely common, with tropical butterflies and other insects. The curious leaf-insect (*Mantis*) was very abundant on the orange trees, on the leaves of which the natives believe it to feed; nor indeed could we persuade some of our friends that its thin sharp jaws are unsuited for masticating leaves, and that these and its prehensile feet indicate its predacious nature: added to which, its singular resemblance to a leaf is no less a provision against its being discovered by its enemies, than an aid in deceiving its prey.

We descended rapidly for many miles through beautiful rocky woods, with villages nestling amongst groves of banana and trellised climbers; and from the brow of a hill looked down upon a slope covered with vegetation and huts, which formed the mart of Chela, and below which the Boga-panee flowed in a deep gorge. The view was a very striking one: owing to the steepness of the valley below our feet, the roofs alone of the cottages were visible,

from which ascended the sounds and smells of a dense native population, and to which there appeared to be no way of descending. The opposite side rose precipitously in lofty table-topped mountains, and the river was studded with canoes.

The descent was fully 800 feet, on a slope averaging 25° to 35°. The cottages were placed close together, each within a little bamboo enclosure, eight to ten yards deep; and no two were on the same level. Each was built against a perpendicular wall which supported a cutting in the bank behind; and a similar wall



CHELA VILLAGE.

descended in front of it, forming the back of the compartment in which the cottage next below it was erected. The houses were often raised on platforms, and some had balconies in front, which overhung the cottage below. All were mere hovels of wattle or mud, with very high-pitched roofs: stone tanks resembling fonts, urns, coffins, and sarcophagi, were placed near the better houses, and blocks of stone were scattered everywhere

We descended from hovel to hovel, alternately along the gravelled flat of each enclosure, and perpendicularly down steps

cut in the sandstone or let into the walls. I counted 800 houses from the river, and there must be many more: the inhabitants are Bengalees and Khasias, and perhaps amount to 3,000 or 4,000; but this is a very vague estimate.

We lodged in a curious house, consisting of one apartment, twenty feet long, and five high, raised thirty feet upon bamboos: the walls were of platted bamboo matting, fastened to strong wooden beams, and one side opened on a balcony that overhung the river. The entrance was an oval aperture reached by a ladder, and closed by folding-doors that turned on wooden pivots. The roof was supported by tressels of great thickness, and like the rest of the woodwork, was morticed, no nails being used throughout the building. The floor was of split bamboos laid side by side.

We ascended the Boga-panee in canoes, each formed of a hollowed trunk fifty feet long and four broad; we could not, however, proceed far, on account of the rapids. The rocks in its bed are limestone, but a great bluff cliff of sandy conglomerate (strike east-south-east and dip south-south-west 70°), several hundred feet high, rises on the east bank close above the village, above which occurs amygdaloidal basalt. The pebbles in the river (which was seventy yards broad, and turbid) were of slate, basalt, sandstone, and syenite: on the opposite bank were sandstones overlain by limestone, both dipping to the southward.

Beautiful palms, especially *Caryota urens* (by far the handsomest in India), and groves of betel-nut bordered the river, with oranges, lemons, and citrons; intermixed with feathery bamboos, horizontally-branched acacias, oaks, with pale red young leaves, and deep green foliaged figs. Prickly rattans and *Plectocomia* climbed amongst these, their enormous plumes of foliage upborne by the matted branches of the trees, and their arrowy tops shooting high above the forest.

After staying three days at Chela, we descended the stream in canoes, shooting over pebbly rapids, and amongst rocks of limestone, water-worn into fantastic shapes, till we at last found ourselves gliding gently along the still canals of the Jheels. Many of these rapids are so far artificial, that they are enclosed by gravel banks, six feet high, which, by confining the waters, give them depth; but, Chela being hardly above the level of the sea, their fall is very trifling. We proceeded across the Jheels[1] to Chattuc, and then north again to Pundua, and so to Churra.

[1] The common water-plants of the Jheels are *Vallisneria serrata*, *Damasonium*, 2 *Myriophylla*, 2 *Villarsiæ*, *Trapa*, blue, white, purple and scarlet water-lilies, *Hydrilla*, *Urticularia*, *Limnophila*, *Azolla*, *Salvinia*, *Ceratopteris*, and floating grasses.

Having pretty well exhausted the botany of Churra, Dr. Thompson and I started on the 13th of September for the eastern part of the Khasia and Jyntea mountains. On the Kala-panee road,[1] which we followed, we passed crowds of market people, laden with dried fish in a half-putrid state, which scented the air for many yards: they were chiefly carp, caught and dried at the foot of the hills. Large parties were bringing down baskets of bird-cherries, cinnamon-bark, iron, pine-planks, fire-wood, and potatoes. Of these, the bird-cherries (like damsons) are made into an excellent preserve by the English residents, who also make capital cherry-brandy of them: the trade in cinnamon is of recent introduction, and is much encouraged by the Inglis family, to whose exertions these people are so greatly indebted; the cinnamon is the peeled bark of a small species of *Cinnamomum* allied to that of Ceylon, and though inferior in flavour and mucilaginous (like cassia), finds a ready market in Calcutta. It has been used to adulterate the Ceylon cinnamon; and an extensive fraud was attempted by some Europeans at Calcutta, who sent boxes of this, with a top layer of genuine, to England. The smell of the cinnamon loads was as fragrant as that of the fish was offensive.

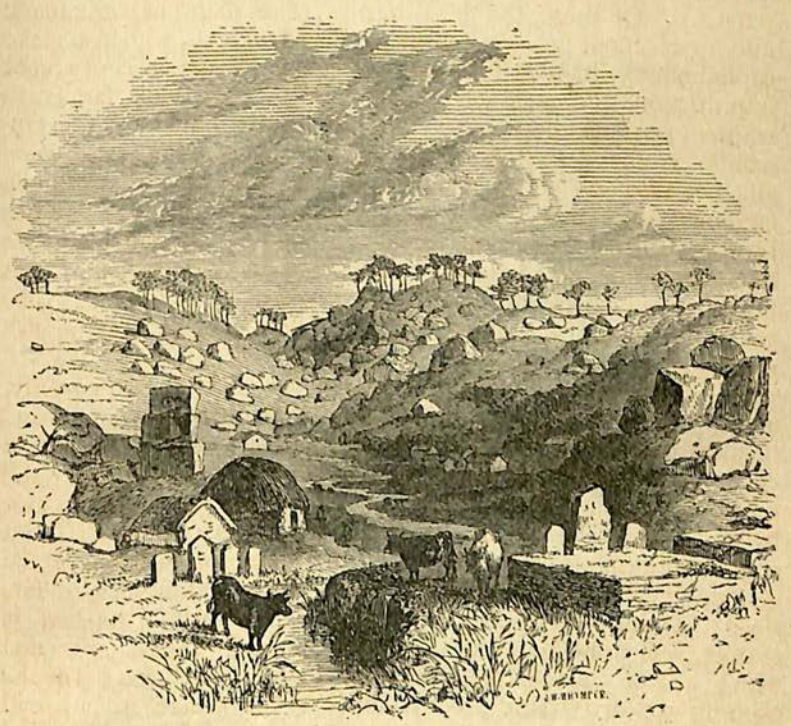
The road from Kala-panee bungalow strikes off north-easterly, and rounds the head of the deep valley to the east of Churra; it then crosses the head-waters of the Kala-panee river, still a clear stream, the bed of which is comparatively superficial: the rocks consist of a little basalt and much sandstone, striking east by north, and dipping north by west. The Boga-panee is next reached, flowing in a shallow valley, about 200 feet below the general level of the hills, which are grassy and treeless. The river[2] is thirty yards across, shallow and turbid; its bed is granite, and beyond it scattered stunted pines are met with; a tree which seems to avoid the sandstone. In the evening we arrived at Nonkreem, a large village in a broad marshy valley, where we procured accommodation with some difficulty, the people being by no means civil, and the Rajah, Sing Manuk, holding himself independent of the British Government.

Atmospheric denudation and weathering have produced re-

[1] The Pea-violet (*Crotalaria occulta*) was very common by the road-side, and smelt deliciously of violets: the English name suggests the appearance of the flower, for which and for its fragrance it is well worth cultivation.

[2] The fall of this river, between this elevation (which may be considered that of its source) and Chela, is about 5,500 feet.

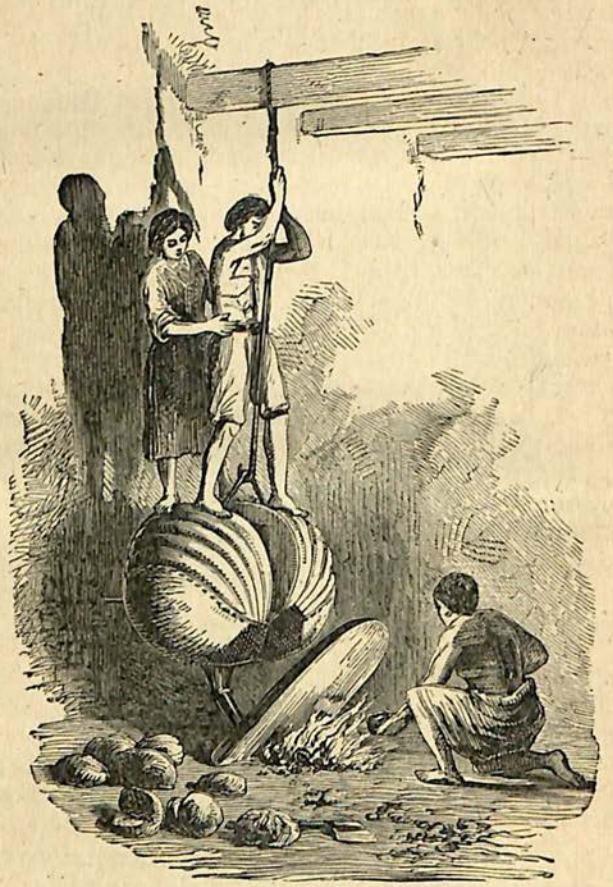
markable effects on the lower part of the Nonkreem valley, which is blocked up by a pine-crested hill, 200 feet high, entirely formed of round blocks of granite, heaped up so as to resemble an old moraine; but like the Nunklow boulders, these are not arranged as if by glacial action. The granite is micaceous, and usually very soft, decomposing into a coarse reddish sand, that colours the Boga-panee. To procure the iron-sand, which is



NONKREEM VILLAGE.

disseminated through it, the natives conduct water over the beds of granite sand, and as the lighter particles are washed away, the remainder is removed to troughs, where the separation of the ore is completed. The smelting is very rudely carried on in charcoal fires, blown by enormous double-action bellows, worked by two persons, who stand on the machine, raising the flaps with their hands, and expanding them with their feet, as shown in the cut at p. 512. There is neither furnace nor flux used in the reduction.

The fire is kindled on one side of an upright stone (like the head-stone of a grave), with a small arched hole close to the ground: near this hole the bellows are suspended; and a bamboo tube from each of its compartments, meets in a larger one, by which the draught is directed under the hole in the stone to the fire.



BELLOWS.

The ore is run into lumps as large as two fists, with a rugged surface: these lumps are afterwards cleft nearly in two, to show their purity.

The scenery about Nonkreem village is extremely picturesque, and we procured many good plants on the rocks, which were

covered with the purple-flowered Orchid, *Cœlogyne Wallichii*. The country is everywhere intersected with trenches for iron-washing, and some large marshes were dammed up for the same purpose: in these we found some beautiful balsams, *Hypericum* and *Parnassia*; also a diminutive water-lily, the flower of which is no larger than a half-crown; it proves to be the *Nymphæa pygmæa* of China and Siberia—a remarkable fact in the geographical distribution of plants.

From Nonkreem we proceeded easterly to Pomrang, leaving Shillong hill on the north, and again crossing the Boga-panee, beyond which the sandstone appeared (strike north-east and dip north-west 60°); the soil was poor in the extreme; not an inhabitant or tree was to be seen throughout the grassy landscape, and hardly a bush, save an occasional rhododendron, dwarf oak, or *Pieris*, barely a few inches high.

At Pomrang we took up our quarters in an excellent empty bungalow, built by Mr. Stainforth (Judge of Silhet), who kindly allowed us the use of it. Its elevation was 5,143 feet, and it occupied the eastern extremity of a lofty spur that overhangs the deep fir-clad valley of the Oongkot, dividing Khasia from Jyntea. The climate of Pomrang is so much cooler and less rainy than at Churra, that this place is more eligible for a station; but the soil is quite impracticable, there is an occasional scarcity of water, the pasture is wholly unsuited for cattle or sheep, and the distance from the plains is too great.

A beautiful view extends eastwards to the low Jyntea hills, backed by the blue mountains of Cachar, over the deep valley in front; to the northward, a few peaks of the Himalaya are seen, and westward is Shillong. We stayed here till the 23rd September, and then proceeded south-eastward to Mooshye. The path descends into the valley of Oongkot, passing the village of Pomrang, and then through woods of pine, *Gordonia*, and oak, the latter closely resembling the English, and infested with galls. The slopes are extensively cultivated with black awnless unirrigated rice, and poor crops of *Coix*, protected from the birds by scarecrows of lines stretched across the fields, bearing tassels and tufts of fern, shaken by boys. This fern proved to be a very curious and interesting genus, which is only known to occur elsewhere at Hong-Kong in China and has been called *Bowringia*, after the eminent Dr. Bowring.

We crossed the river [1] twice, proceeding south-west to Mooshye,

[1] *Podostemon* grew on the stones at the bottom: it is a remarkable water-plant, resembling a liver-wort in its mode of growth. Several species occur.

a village placed on an isolated, flat-topped, and very steep-sided hill, 4,863 feet above the sea, and perhaps 3,500 above the Oongkot, which winds round its base. A very steep path led up slate rocks to the top (which was of sandstone), where there is a stockaded guard-house, once occupied by British troops, of which we took possession. A Labiate plant (*Mesona Wallichiana*) grew on the ascent, whose bruised leaves smelt as strongly of patchouli, as do those of the plant producing that perfume, to which it is closely allied. The *Pogostemon Patchouli* has been said to occur in these parts of India, but we never met with it, and doubt the accuracy of the statement. It is a native of the Malay peninsula, whence the leaves are imported into Bengal, and so to Europe.

The summit commands a fine view northward of some Himalayan peaks, and southwards of the broad valley of the Oongkot, which is level, and bounded by steep and precipitous hills, with flat tops. On the 25th we left Mooshye for Amwee in Jyntea, which lies to the south-east. We descended by steps cut in the sandstone, and fording the Oongkot, climbed the hills on its east side, along the grassy tops of which we continued, at an elevation of 4,000 feet. Marshy flats intersect the hills, to which wild elephants sometimes ascend, doing much damage to the rice crops. We crossed a stream by a bridge formed of one gigantic block of sandstone, 20 feet long, close to the village, which is a wretched one, and is considered unhealthy: it stands on the high road from Jynteapore (at the foot of the hills to the southward) to Assam: the only road that crosses the mountains east of that from Churra to Nunklow.

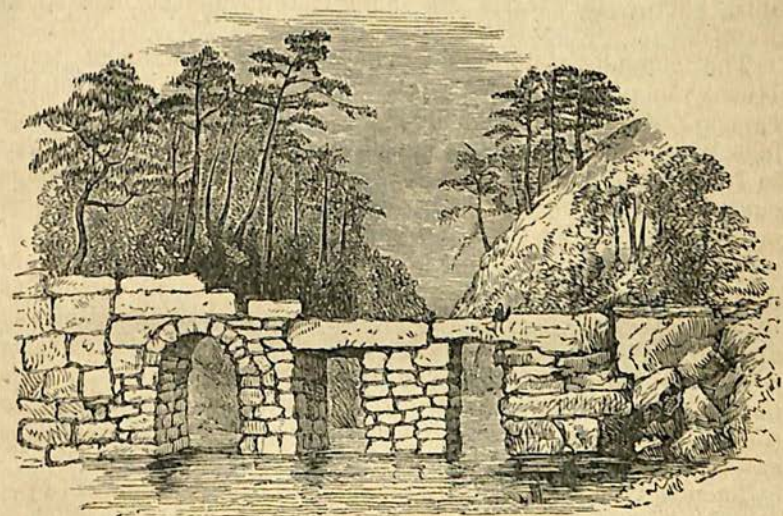
Though so much lower, this country, from the barrenness of the soil, is more thinly inhabited than the Khasia. The pitcher-plant (*Nepenthes*) grows on stony and grassy hills about Amwee, and crawls along the ground; its pitchers seldom contain insects in the wild state, nor can we suggest any special function for the wonderful organ it possesses.

About eight miles south of the village is a stream, crossed by

at different elevations in the Khasia, and appear only in autumn, when they often carpet the bottom of the streams with green. In spring and summer no traces of them are seen; and it is difficult to conceive what becomes of the seeds in the interval, and how these, which are well known, and have no apparent provision for the purpose, attach themselves to the smooth rocks at the bottom of the torrents. All the kinds are said to flower and ripen their seeds under water; the stamens and pistil being protected by the closed flower from the wet. This genus does not inhabit the Sikkim rivers, probably owing to the great changes of temperature to which these are subject.

a bridge, half of which is formed of slabs of stone (of which one is twenty-one feet long, seven broad, and two feet three and a half inches thick), supported on piers, and the rest is a well turned arch, such as I have not seen elsewhere among the hill tribes of India. It is fast crumbling away, and is covered with tropical plants, and a beautiful white-flowered orchis [1] grew in the mossy crevices of its stones.

From Amwee our route lay north-east across the Jyntea hills to Joowye, the hill-capital of the district. The path gradually ascended, dipping into valleys scooped out in the horizontal sandstone down to the basalt; and boulders of the same rock



OLD BRIDGE AT AMWEE.

were scattered about. Fields of rice occupy the bottoms of these valleys, in which were placed gigantic images of men, dressed in rags, and armed with bows and arrows, to scare away the wild elephants! Slate rocks succeed the sandstone (strike north-east, dip north-west), and with them pines and birch appear, clothing the deep flanks of the Mintadoong valley, which we crossed.

The situation of Joowye is extremely beautiful: it occupies the broken wooded slope of a large open flat valley, dotted with

[1] *Diplomeris; Apostasia* also grew in this gulley, with a small *Arundina*, some beautiful species of *Sonerila*, and *Argostemma*. The neighbourhood was very rich in plants.

pines; and consists of an immense number of low thatched cottages, scattered amongst groves of bamboo, and fields of plantain, tobacco, yams, sugar-cane, maize, and rice, surrounded by hedges of bamboo, *Colquhounia*, and *Erythrina*. Narrow steep lanes lead amongst these, shaded with oak, birch, *Podocarpus*, Camellia, and *Araliaceæ*; the larger trees being covered with orchids, climbing palms, *Pothos*, *Scindapsus*, pepper, and *Gnetum*; while masses of beautiful red and violet balsams grew under every hedge and rock. The latter was of sandstone, overlying highly inclined schists, and afforded magnificent blocks for the natives to rear on end, or make seats of. Some erect stones on a hill at the entrance are immensely large, and surround a clump of fine fig and banyan trees.[1]

We procured a good house after many delays, for the people were far from obliging; it was a clean, very long cottage, with low thatched eaves almost touching the ground, and was surrounded by a high bamboo paling that enclosed out-houses built on a well-swept floor of beaten earth. Within, the woodwork was carved in curious patterns, and was particularly well fitted. The old lady to whom it belonged got tired of us before two days were over, and first tried to smoke us out by a large fire of green wood at that end of the cottage which she retained; and afterwards by inviting guests to a supper, with whom she kept up a racket all night. Her son, a tall, sulky fellow, came to receive the usual gratuity on our departure, which we made large to show we bore no ill-will: he, however, behaved so scornfully, pretending to despise it, that I had no choice but to pocket it again; a proceeding which was received with shouts of laughter, at his expense, from a large crowd of bystanders.

On the 30th of September we proceeded north-east from Joowye to Nurtiung, crossing the watershed of the Jyntea range, which is granitic, and scarcely raised above the mean level of the hills; it is about 4,500 feet elevation. To the north the descent is at first rather abrupt for 500 feet, to a considerable stream, beyond which is the village of Nurtiung. The country gradually declines hence to the north-east, in grassy hills, which to the east become higher and higher and more wooded: to the west the Khasia are seen, and several Himalayan peaks to the north.

[1] In some tanks we found *Hydropeltis*, an American and Australian plant allied to *Nymphæa*. Mr. Griffith first detected it here, and afterwards in Bhotan, these being the only known habitats for it in the Old World. It grows with *Typha*, *Acorus Calamus* (sweet flag), *Vallisneria*, *Potamogeton*, *Sparganium*, and other European water-plants.

The ascent to the village from the river is by steps cut in a narrow cleft of the schist rocks, to a flat, elevated 4,178 feet above the sea: we here procured a cottage, and found the people remarkably civil. The general appearance is the same as at Joowye, but there are here extensive and very unhealthy marshes, whose evil effects we experienced, in having the misfortune to lose one of our servants by fever. Except pines, there are few large trees; but the quantity of species of perennial woody plants contributing to form the jungle is quite extraordinary: I enumerated 140, of which 60 were trees or large shrubs above twenty feet high. One of these was the *Hamamelis chinensis*, a plant hitherto only known as a native of China. This, the *Bowringia*, and the little *Nymphæa*, are three out of many remarkable instances of our approach to the eastern Asiatic flora.

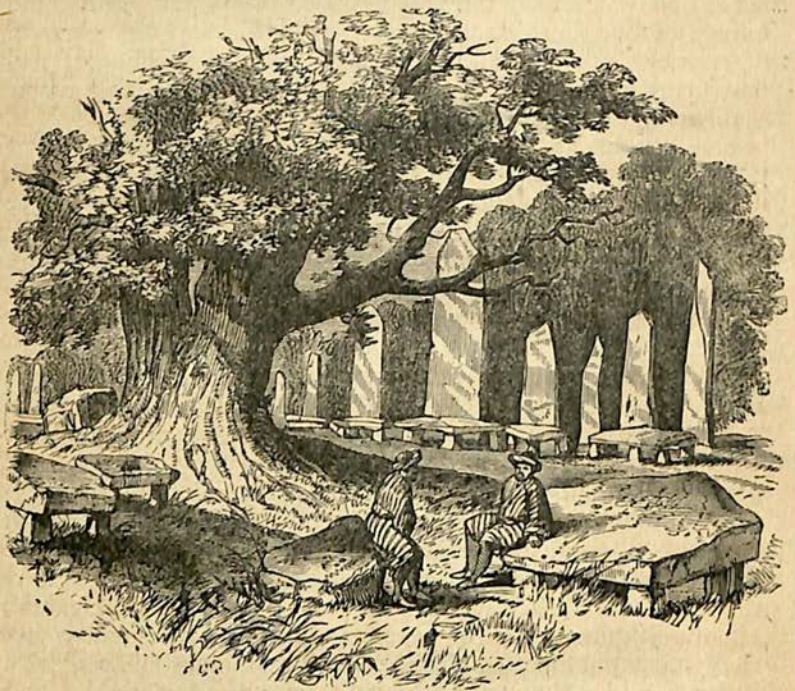
From Nurtiung we walked to the Bor-panee river, sixteen or twenty miles to the north-east (not the river of that name below Nunklow), returning the same night; a most fatiguing journey in so hot and damp a climate. The path lay for the greatest part of the way over grassy hills of mica-schist, with boulders of granite, and afterwards of syenite, like those of Nunklow. The descent to the river is through noble woods of spreading oaks,[1] chestnuts, magnolias, and tall pines: the vegetation is very tropical, and with the exception of there being no sal, it resembles that of the dry hills of the Sikkim Terai. The Bor-panee is forty yards broad, and turbid; its bed, which is of basalt, 2,454 feet above the sea: it is crossed by a raft pulled to and fro by canes.

Nurtiung contains a most remarkable collection of those sepulchral and other monuments, which form so curious a feature in the scenery of these mountains and in the habits of their savage population. They are all placed in a fine grove of trees, occupying a hollow; where several acres are covered with gigantic, generally circular, slabs of stone, from ten to twenty-five feet broad, supported five feet above the ground upon other blocks. For the most part they are buried in brushwood of nettles and shrubs, but in one place there is an open area of fifty yards encircled by them, each with a gigantic headstone behind it. Of the latter the tallest was nearly thirty feet high, six broad, and two feet eight inches in thickness, and must have been sunk at least five feet, and perhaps much more, in the ground. The flat slabs were generally of slate or hornstone; but many of them, and all

[1] We collected upwards of fifteen kinds of oak and chestnut in these and the Khasia mountains; many are magnificent trees, with excellent wood, while others are inferior as timber.

the larger ones, were of syenitic granite, split by heat and cold water with great art. They are erected by dint of sheer brute strength, the lever being the only aid. Large blocks of syenite were scattered amongst these wonderful erections.

Splendid trees of *Bombax*, fig and banyan, overshadowed them: the largest banyan had a trunk five feet in diameter, clear of the buttresses, and numerous small trees of *Celtis* grew out of it, and an immense flowering tuft of *Vanda cærulea* (the rarest and most beautiful of Indian orchids) flourished on one of its limbs. A



STONES AT NURTIUNG.

small plantain with austere woolly scarlet fruit, bearing ripe seeds, was planted in this sacred grove, where trees of the most tropical genera grew mixed with the pine, birch, *Myrica*, and *Viburnum*.

The Nurtiung Stonehenge is no doubt in part religious, as the grove suggests, and also designed for cremation, the bodies being burnt on the altars. In the Khasia these upright stones are generally raised simply as memorials of great events, or of men

whose ashes are not necessarily, though frequently, buried or deposited in hollow stone sarcophagi near them, and sometimes in an urn placed inside a sarcophagus, or under horizontal slabs.

The usual arrangement is a row of five, seven, or more erect oblong blocks with round heads (the highest being placed in the middle), on which are often wooden discs and cones: more rarely pyramids are built. Broad slabs for seats are also common by the wayside. Mr. Yule, who first drew attention to these monuments, mentions one thirty-two feet by fifteen, and two in thickness; and states that the sarcophagi (which, however, are rare) formed of four slabs, resemble a drawing in Bell's Circassia, and descriptions in Irby and Mangles' Travels in Syria. He adds that many villages derive their names from these stones, "mau" signifying "stone:" thus "Mausmai" is "the stone of oath," because, as his native informant said, "there was war between Churra and Mausmai, and when they made peace, they swore to it, and placed a stone as a witness;" forcibly recalling the stone Jacob set up for a pillar, and other passages in the Old Testament. "Mamloo" is "the stone of salt," eating salt from a sword's point being the Khasia form of oath: "Mauflong" is "the grassy stone," &c.[1] Returning from this grove, we crossed a stream by a single squared block, twenty-eight feet long, five broad, and two thick, of gray syenitic granite with large crystals of felspar.

We left Nurtiung on the 4th of October, and walked to Pomrang, a very long and fatiguing day's work. The route descends north-west of the village, and turns due east along bare grassy hills of mica-schist and slate (strike east and west, and dip north). Near the village of Lernai oak woods are passed, in which *Vanda cærulea* grows in profusion, waving its panicles of azure flowers in the wind. As this beautiful orchid is at present attracting great attention, from its high price, beauty, and difficulty of culture, I shall point out how totally at variance with its native habits is the cultivation thought necessary for it in England.[2] The dry

[1] Notes on the Khasia mountains and people; by Lieutenant H. Yule, Bengal Engineers. Analogous combinations occur in the south of England and in Brittany, &c., where similar structures are found. Thus *maen*, *man*, or *men* is the so-called Druidical name for a stone, whence *Pen-maen-mawr*, for "the hill of the big stone," *Maen-hayr*, for the standing stones of Brittany, and *Dol-men*, "the table-stone," for a cromlech.

[2] We collected seven men's loads of this suberb plant for the Royal Gardens at Kew; but owing to unavoidable accidents and difficulties, few specimens reached England alive. A gentleman who sent his gardener with us to be shown the locality, was more successful: he sent one man's load to England

grassy hills which it inhabits are elevated 3,000 to 4,000 feet: the trees are small, gnarled, and very sparingly leafy, so that the Vanda which grows on their limbs is fully exposed to sun, rain, and wind. There is no moss or lichen on the branches with the Vanda, whose roots sprawl over the dry rough bark. The atmosphere is on the whole humid, and extremely so during the rains; but there is no damp heat, or stagnation of the air, and at the flowering season the temperature ranges between 60° and 80°, there is much sunshine, and both air and bark are dry during the day: in July and August, during the rains, the temperature is a little higher than above, but in winter it falls much lower, and hoar-frost forms on the ground. Now this winter's cold, summer's heat, and autumn's drought, and above all, this constant free exposure to fresh air and the winds of heaven, are what of all things we avoid exposing our orchids to in England. It is under these conditions, however, that all the finer Indian *Orchideæ* grow, of which we found *Dendrobium Farmeri*, *Dalhousianum*, *Devonianum*, &c., with *Vanda cærulea;* whilst the most beautiful species of *Cœlogyne*, *Cymbidium*, *Bolbophyllum*, and *Cypripedium*, inhabit cool climates at elevations above 4,000 feet in Khasia, and as high as 6,000 to 7,000 in Sikkim.

On the following day we turned out our Vanda to dress the specimens for travelling, and preserve the flowers for botanical purposes. Of the latter we had 360 panicles, each composed of from six to twenty-one broad pale-blue tesselated flowers, three and a half to four inches across: and they formed three piles on the floor of the verandah, each a yard high:—what would we not have given to have been able to transport a single panicle to a Chiswick fête!

On the 10th of October we sent twenty-four strong mountaineers to Churra, laden with the collections of the previous month; whilst we returned to Nonkreem, and crossing the shoulder of Shillong, passed through the village of Moleem in a north-west direction to the Syong bungalow. From this we again crossed the range to Nunklow and the Bor-panee, and returned by Moflong and the Kala-panee to Churra during the latter part of the month.

In November the vegetation above 4,000 feet turns wintry and

on commission, and though it arrived in a very poor state, it sold for 300*l.*, the individual plants fetching prices varying from 3*l.* to 10*l.* Had all arrived alive, they would have cleared 1,000*l.* An active collector, with the facilities I possessed, might easily clear from 2,000*l.* to 3,000*l.*, in one season, by the sale of Khasia orchids.

brown, the weather becomes chilly, and though the cold is never great, hoar-frost forms at Churra, and water freezes at Moflong. We prepared to leave as these signs of winter advanced: we had collected upwards of 2,500 species, and for the last few weeks all our diligence, and that of our collectors, had failed to be rewarded by a single novelty. We however procured many species in fruit, and made a collection of upwards of 300 kinds of woods, many of very curious structure. As, however, we projected a trip to Cachar before quitting the neighbourhood, we retained our collectors, giving orders for them to meet us at Chattuc, on our way down the Soormah in December, with our collections, which amounted to 200 men's loads, and for the conveyance of which to Calcutta, Mr. Inglis procured us boats.

Before dismissing the subject of the Khasia mountains, it will be well to give a slight sketch of their prominent geographical features, in connection with their geology. The general geological characters of the chain may be summed up in a few words. The nucleus or axis is of highly inclined stratified metamorphic rocks, through which the granite has been protruded, and the basalt and syenite afterwards injected. After extensive denudations of these, the sandstone, coal, and limestone were successively deposited. These are altered and displaced along the southern edge of the range, by black amygdaloidal trap, and have in their turn been extensively denuded; and it is this last operation that has sculptured the range, and given the mountains their present aspect; for the same gneisses, slates, and basalts in other countries, present rugged peaks, domes, or cones, and there is nothing in their composition or arrangement here that explains the tabular or rounded outline they assume, or the uniform level of the spurs into which they rise, or the curious steep sides and flat floors of the valleys which drain them.

All these peculiarities of outline are the result of denudation, of the specific action of which agent we are very ignorant. The remarkable difference between the steep cliffs on the south face of the range, and the rounded outline of the hills on the northern slopes, may be explained on the supposition that when the Khasia was partially submerged, the Assam valley was a broad bay or gulf; and that while the Churra cliffs were exposed to the full sweep of the ocean, the Nunklow shore was washed by a more tranquil sea.

The broad flat marshy heads of all the streams in the central and northern parts of the chain, and the rounded hills that separate them, indicate the levelling action of a tidal sea, acting

on a low flat shore;[1] whilst the steep flat-floored valleys of the southern watershed may be attributed to the scouring action of higher tides on a boisterous rocky coast. These views are confirmed by an examination of the east shores of the Bay of Bengal, and particularly by a comparison of the features of the country about Silhet, now nearly 200 miles distant from the sea, with those of the Chittagong coast, with which they are identical.

The geological features of the Khasia are in many respects so similar to those of the Vindhya, Kymore, Behar, and Rajmahal mountains, that they have been considered by some observers as an eastern prolongation of that great chain, from which they are geographically separated by the delta of the Ganges and Burrampooter. The general contour of the mountains, and of their sandstone cliffs, is the same, and the association of this rock with coal and lime is a marked point of similarity; there is, however, this difference between them, that the coal-shales of Khasia and limestone of Behar are non-fossiliferous, while the lime of Khasia and the coal-shales of Behar contain fossils.

The prevalent north-east strike of the gneiss is the same in both, differing from the Himalaya, where the stratified rocks generally strike north-west. The nummulites of the limestone are the only means we have of forming an approximate estimate of the age of the Khasia coal, which is the most interesting feature in the geology of the range: these fossils have been examined by MM. Archiac and Jules Haines,[2] who have pronounced the species collected by Dr. Thomson and myself to be the same as those found in the nummulite rocks of north-west India, Scinde, and Arabia.

[1] Since our return to England, we have been much struck with the similarity in contour of the Essex and Suffolk coasts, and with the fact that the tidal coast sculpturing of this surface is preserved in the very centre of High Suffolk, twenty to thirty miles distant from the sea, in rounded outlines and broad flat marshy valleys.

[2] "Description des Animaux Fossiles des Indes Orientales," p. 178. These species are *Nummulites scabra*, Lamarck, *N. obtusa*, Sowerby, *N. Lucasana*, Deshayes, and *N. Beaumonti*, d'Arch. and Haines.

CHAPTER XXXI.

Boat voyage to Silhet—River—Palms—Teelas—Botany—Fish weirs—Forests of Cachar—Sandal-wood, &c.—Porpoises—Alligators—Silchar—Tigers—Rice-crops—Cookies—Munniporees—Hockey—Varnish—Dance—Nagas—Excursion to Munnipore frontier—Elephant bogged—Bamboos—*Cardiopteris*—Climate, &c., of Cachar—Mosquitos—Fall of banks—Silhet—Oaks—*Stylidium*—Tree-ferns—Chattuc—Megna—Meteorology—Palms—Noacolly—Salt-smuggling—Delta of Ganges and Megna—Westward progress of Megna—Peat—Tide—Waves—Earthquakes—Dangerous navigation—Moonlight scenes—Mud island—Chittagong—Mug tribes—Views—Trees—Churs—Flagstaff hill—Coffee—Pepper—Tea, &c.—Excursions from Chittagong—*Dipterocarpi* or Gurjun oil trees—Earthquake—Birds—Papaw—Bleeding of stems—Poppy and Sun fields—Seetakoond—Bungalow and hill—Perpetual flame—*Falconeria*—*Cycas*—Climate—Leave for Calcutta—Hattiah island—Plants—Sunderbunds—Steamer—Tides—*Nipa fruticans*—Fishing—Otters—Crocodiles—*Phœnix paludosa*—Departure from India.

WE left Churra on the 17th of November, and taking boats at Pundua, crossed the Jheels to the Soormah, which we ascended to Silhet. Thence we continued our voyage 120 miles up the river in canoes, to Silchar, the capital of the district of Cachar: the boats were such as I described at Chattuc, and though it was impossible to sit upright in them, they were paddled with great swiftness. The river at Silhet is 200 yards broad; it is muddy, and flows with a gentle current of two to three miles an hour, between banks six to twelve feet high. As we glided up its stream, villages became rarer, and eminences more frequent in the Jheels. The people are a tall, bold, athletic Mahometan race, who live much on the water, and cultivate rice, sesamum, and radishes, with betel-pepper in thatched enclosures as in Sikkim: maize and sugar are rarer, bamboos abound, and four palms (*Borassus*, *Areca*, cocoa-nut, and *Caryota*) are planted, but there are no date-palms.

The Teelas (or hillocks) are the haunts of wild boars, tigers, and elephants, but not of the rhinoceros; they are 80 to 200 feet high, of horizontally stratified gravel and sand, slates, and clay conglomerates, with a slag-like honey-combed sandstone; they are covered with oaks, figs, *Heretiera*, and bamboos, and besides a multitude of common Bengal plants, there are some which, though generally considered mountain or country genera, here descend to the level of the sea; such are *Kadsura*, *Rubus*, *Camellia* and *Sabia*; *Acrides* and *Saccolabia* are the common orchids, and rattan-canes and *Pandani* render the jungles impenetrable.

A very long sedge *(Scleria)* grows by the water, and is used for thatching: boatloads of it are collected for the Calcutta market, for which also were destined many immense rafts of bamboo, 100 feet long. The people fish much, using square and triangular drop-nets stretched upon bamboos, and rude basket-work weirs, that retain the fish as the river falls. Near the villages we saw fragments of pottery three feet below the surface of the ground, showing that the bank, which is higher than the surrounding country, increases from the annual overflow.

About seventy miles up the river, the mountains on the north, which are east of Jyntea, rise 4,000 feet high in forest-clad ranges like those of Sikkim. Swamps extend from the river to their base, and penetrate their valleys, which are extremely malarious: these forests are frequented by timber-cutters, who fell jarool *(Lagerstræmia Reginæ)*, a magnificent tree with red wood, which, though soft, is durable under water, and therefore in universal use for boat-building. The toon is also cut, with red sandal-wood *(Adenanthera pavonina)*; also Nageesa,[1] *Mesua ferrea*, which is highly valued for its weight, strength and durability: *Aquilaria agallocha*, the eagle-wood, a tree yielding uggur oil, is also much sought for its fragrant wood, which is carried to Silhet and Azmerigunj, where it is broken up and distilled. Neither teak, sissoo, sal, nor other *Dipterocarpi*, are found in these forests.

Porpoises, and both the long and the short-nosed alligator, ascend the Soormah for 120 miles, being found beyond Silchar, which place we reached on the 22nd, and most hospitably received by Colonel Lister, the political agent commanding the Silhet Light Infantry, who was inspecting the Cookie levy, a corps of hill-natives which had lately been enrolled.

The station is a small one, and stands about forty feet above the river, which however rises half that height in the rains. Long low spurs of tertiary rocks stretch from the Tipperah hills for many miles north, through the swampy Jheels to the river; and there are also hills on the opposite or north side, but detached from the Cookie hills, as the lofty blue range twelve miles north

[1] There is much dispute amongst oriental scholars about the word Nageesa; the Bombay philologists refer it to a species of *Garcinia*, whilst the pundits on the Calcutta side of India consider it to be *Mesua ferrea*. Throughout our travels in India, we were struck with the undue reliance placed on native names of plants, and information of all kinds; and the pertinacity with which each linguist adhered to his own crochet as to the application of terms to natural objects, and their pronunciation. It is a very prevalent, but erroneous, impression, that savage and half-civilised people have an accurate knowledge of objects of natural history, and a uniform nomenclature for them.

of the Soormah is called. All these mountains swarm with tigers, wild buffalos, and boars, which also infest the long grass of the Jheels.

The elevation of the house we occupied at Silchar was 116 feet above the sea. The bank it stood on was of clay, with soft rocks of conglomerate, which often assume the appearance of a brown sandy slag.

During the first Birmese war, Colonel Lister was sent with a force up to this remote corner of Bengal, when the country was an uninhabited jungle, so full of tigers that not a day passed without one or more of his grass- or wood-cutters being carried off. Now, thousands of acres are cultivated with rice, and during our stay we did not see a tiger. The quantity of land brought into cultivation in this part of Bengal, and indeed throughout the Gangetic delta, has probably been doubled during the last twenty years, and speaks volumes for the state of the peasant under the Indian Company's sway, as compared with his former condition. The Silchar rice is of admirable quality, and much is imported to Silhet, the Jheels not producing grain enough for the consumption of the people. Though Silchar grows enough for ten times its population, there was actually a famine six weeks before our arrival, the demand from Silhet being so great.

The villages of Cachar are peopled by Mahometans, Munniporees, Nagas, and Cookies; the Cacharies themselves being a poor and peaceful jungle tribe, confined to the mountains north of the Soormah. The Munniporees[1] are emigrants from the kingdom of that name, which lies beyond the British possessions, and borders on Assam and Birmah. Low ranges of forest-clad mountains at the head of the Soormah, separate it from Silchar, with which it is coterminous; the two chief towns being seven marches apart. To the south-east of Silchar are interminable jungles, peopled by the Cookies, a wild Indo-Chinese tribe, who live in a state of constant warfare, and possess the whole hill-country from this, southward to beyond Chittagong. Two years ago they invaded and ravaged Cachar, carrying many of the

[1] The Munnipore valley has never been explored by any naturalist, its mountains are said to be pine-clad, and to rise 8,000 feet above the level of the sea. The Rajah is much harassed by the Burmese, and is a dependant of the British, who are in the very frequent dilemma of supporting on the throne a sovereign opposed by a strong faction of his countrymen, and who has very dubious claims to his position. During our stay at Silchar, the supposed rightful Rajah was prevailing over the usurper; a battle had been fought on the hills on the frontier, and two bodies floated past our bungalow, pierced with arrows.

inhabitants into slavery, and so frightening the people, that land previously worth six rupees a biggah, is now reduced to one and a half. Colonel Lister was sent with a strong party to rescue the captives, and marched for many days through their country without disturbing man or beast; penetrating deep forests of gigantic trees and tall bamboos, never seeing the sun above, or aught to the right and left, save an occasional clearance and a deserted village. The incursion, however, had its effects, and the better inclined near the frontier have since come forward, and been enrolled as the Cookie levy.

The Munnipore emigrants are industrious settlers for a time, but never remain long in one place: their religion is Hindoo, and they keep up a considerable trade with their own country, whence they import a large breed of buffalos, ponies, silks, and cotton cloths dyed with arnotto (*Bixa*), and universally used for turbans. They use bamboo blowing-tubes and arrows for shooting birds, make excellent shields of rhinoceros hide (imported from Assam), and play at hockey on horseback like the Western Tibetans. A fine black varnish from the fruit of *Holigarna longifolia*, is imported from Munnipore, as is another made from *Sesuvium Anacardium* (marking-nut), and a remarkable black pigment resembling that from *Melanorhœa usitatissima*, which is white when fresh, and requires to be kept under water.[1]

One fine moonlight night we went to see a Munnipore dance. A large circular area was thatched with plaintain leaves, growing on their trunks, which were stuck in the ground; and round the enclosure was a border neatly cut from the white leaf-sheaths of the same tree. A double enclosure of bamboo, similarly ornamented, left an inner circle for the performers, and an outer for the spectators: the whole was lighted with oil lamps and Chinese paper lanterns. The musicians sat on one side, with cymbals, tomtoms, and flutes, and sang choruses.

The performances began by a copper-coloured Cupid entering and calling the virgins with a flute; these appeared from a green-room, to the number of thirty or forty, of all ages and sizes. Each had her hair dressed in a topknot, and her head covered with a veil; a scarlet petticoat loaded with tinsel concealed her naked feet, and over this was a short red kirtle, and an enormous

[1] This turns of a beautiful black colour when applied to a surface, owing, according to Sir D. Brewster, to the fresh varnish consisting of a congeries of minute organised particles, which disperse the rays of light in all directions; the organic structure is destroyed when the varnish dries, and the rays of light are consequently transmitted.

white shawl was swathed round the body from the armpits to the waist. A broad belt passed over the right shoulder and under the left arm, to which hung gold and silver chains, corals, &c., with tinsel and small mirrors sewed on everywhere: the arms and hands were bare, and decorated with bangles and rings.

Many of the women were extremely tall, great stature being common amongst the Munniporees. They commenced with a prostration to Cupid, around whom they danced very slowly, with the arms stretched out, and the hands in motion; at each step the free foot was swung backwards and forwards. Cupid then chose a partner, and standing in the middle went through the same motions, a compliment the women acknowledged by curtseying and whirling round, making a sort of cheese with their petticoats, which, however, were too heavy to inflate properly.

The Nagas are another people found on this frontier, chiefly on the hills to the north: they are a wild, copper-coloured, uncouth jungle tribe who have proved troublesome on the Assam frontier. Their features are more Tartar than those of the Munniporees, especially amongst the old men. They bury their dead under the threshold of their cottages. The men are all but naked, and stick plumes of hornbills' feathers in their hair, which is bound with strips of bamboo: tufts of small feathers are passed through their ears, and worn as shoulder lappets. A short blue cotton cloth, with a fringe of tinsel and tufts of goat's hair dyed red, is passed over the loins in front only: they also wear brass armlets, and necklaces of cowries, coral, amber, ivory, and boar's teeth. The women draw a fringed blue cloth tightly across the breast, and wear a checked or striped petticoat. They are less ornamented than the men, and are pleasing looking; their hair is straight, and cut short over the eyebrows.

The Naga dances are very different from those of the Munniporees; being quick, and performed in excellent time to harmonious music. The figures are regular, like quadrilles and country-dances: the men hold their knives erect during the performance, the women extend their arms only when turning partners, and then their hands are not given, but the palms are held opposite. The step is a sort of polka and balancez, very graceful and lively. A bar of music is always played first, and at the end the spectators applaud with two short shouts. Their ear for music, and the nature of their dance, are as Tibetan as their countenances, and different from those of the Indo-Chinese tribes of the frontier.

We had the pleasure of meeting Lieutenant Raban at Silchar, and of making several excursions in the neighbourhood with him;

for which Colonel Lister here, as at Churra, afforded us every facility of elephants and men. Had we had time, it was our intention to have visited Munnipore, but we were anxious to proceed to Chittagong. I however made a three days' excursion to the frontier, about thirty miles distant, proceeding along the north bank of the Soormah. On the way my elephant got bogged in crossing a deep muddy stream: this is sometimes an alarming position, as should the animal become terrified, he will seize his rider, or pad, or any other object (except his driver), to place under his knees to prevent his sinking. In this instance the driver in great alarm ordered me off, and I had to flounder out through the black mud. The elephant remained fast all night, and was released next morning by men with ropes.

The country continued a grassy level, with marshes and rice cultivation, to the first range of hills, beyond which the river is unnavigable; there also a forest commences, of oaks, figs, and the common trees of east Bengal. The road hence was a good one, cut by Sepoys across the dividing ranges, the first of which is not 500 feet high. On the ascent bamboos abound, of the kind called Tuldah or Dulloah, which has long very thin-walled joints; it attains no great size, but is remarkably gregarious. On the east side of the range, the road runs through soft shales and beds of clay, and conglomerates, descending to a broad valley covered with gigantic scattered timber-trees of jarool, acacia, *Diospyros*, *Urticeæ*, and *Bauhiniæ*, rearing their enormous trunks above the bamboo jungle: immense rattan-canes wound through the forest, and in the gullies were groves of two kinds of tree-fern, two of *Areca*, *Wallichia* palm, screw-pine, and *Dracæna*. Wild rice grew abundantly in the marshes, with tall grasses; and *Cardiopteris*[1] covered the trees for upwards of sixty feet, like hops, with a mass of pale-green foliage, and dry white glistening seed-vessels. This forest differed from those of the Silhet and Khasia mountains, especially in the abundance of bamboo jungle, which is, I believe, the prevalent feature of the low hills in Birmah, Ava, and Munnipore; also in the gigantic size of the rattans, larger palms, and different forest trees, and in the scanty undergrowth of herbs and bushes. I only saw, however, the skirts of the forest; the mountains further east, which I am told rise several thousand feet in limestone cliffs, are doubtless richer in herbaceous plants.

The climate of Cachar partakes of that of the Jheels in its damp equable character: during our stay the weather was fine,

[1] A remarkable plant of unknown affinity; see Brown and Bennett, "Flora Javæ:" it is found in the Assam valley and Chittagong.

but dense fogs formed in the morning: the mean maximum was 80°, minimum 51° 4.[1]

The annual rain-fall in 1850 was 111·60 inches, according to a register kindly given me by Captain Verner. There are few mosquitos, which is one of the most curious facts in the geographical distribution of these capricious blood-suckers; for the locality is surrounded by swamps, and they swarm at Silhet, and on the river lower down. Both on the passage up and down, we were tormented in our canoes by them for eighty or ninety miles above Silhet, but from thence onwards to Cachar we were free.

On the 30th of November, we were preparing for our return to Silhet, and our canoes were loading, when we were surprised by a loud rushing noise, and saw a high wave coming down the river, swamping every boat that remained on its banks, whilst most of those that pushed out into the stream, escaped with a violent rocking. It was caused by a slip of the bank three quarters of a mile up the stream, of no great size, but which propagated a high wave. This appeared to move on at about the rate of a mile in three or four minutes, giving plenty of time for our boatmen to push out from the land on hearing the shouts of those first overtaken by the calamity; but they were too timid, and consequently one of our canoes, full of papers, instruments, and clothes, was swamped. Happily our dried collections were not embarked, and the hot sun repaired much of the damage.

We left in the evening of the 2nd of December, and proceeded to Silhet, where we were kindly received by Mr. Stainforth, the district judge. Silhet, the capital of the district of the same name, is a large Mahometan town, occupying a slightly raised part of the Jheels, where many of the Teelas seem joined together by beds of gravel and sand. In the rains it is surrounded by water, and all communication with other parts is by boats: in winter, Jynteapore and Pundua may be reached by land, crossing creeks innumerable on the way. Mr. Stainforth's house, like those of most of the other Europeans, occupies the top of one of the Teelas, 150 feet high, and is surrounded by fine spreading oaks,[2] *Garcinia*, and

[1] The temperature does not rise above 90° in summer, nor sink below 45° or 50° in January: forty-seven comparative observations with Calcutta showed the mean temperature to be 1° 8 lower at Silchar, and the air damper, the saturation-point being, at Calcutta, 0·3791, at Silchar 0·4379.

[2] It is not generally known that oaks are often very tropical plants; not only abounding at low elevations in the mountains, but descending in abundance to the level of the sea. Though unknown in Ceylon, the Peninsula of India, tropical Africa, or South America, they abound in the hot valleys of the Eastern

Diospyros trees. The rock of which the hill is composed, is a slag-like ochreous sandstone, covered in most places with a shrubbery of rose-flowered *Melastoma*, and some peculiar plants.[1]

Broad flat valleys divide the hills, and are beautifully clothed with a bright green jungle of small palms, and many kinds of ferns. In sandy places, blue-flowered *Burmannia*, *Hypoxis*, and other pretty tropical annuals, expand their blossoms, with an inconspicuous *Stylidium*, a plant belonging to a small natural family, whose limits are so confined to New Holland, that this is almost the only kind that does not grow in that continent. Where the ground is swampy, dwarf *Pandanus* abounds, with the gigantic nettle, *Urtica crenulata* ("Mealum-ma" of Sikkim, see p. 424).

The most interesting botanical ramble about Silhet is to the tree-fern groves on the path to Jynteapore, following the bottoms of shallow valleys between the Teelas, and along clear streams, up whose beds we waded for some miles, under an arching canopy of tropical shrubs, trees, and climbers, tall grasses, screw-pines, and *Aroideæ*. In the narrower parts of the valleys the tree-ferns are numerous on the slopes, rearing their slender brown trunks forty feet high, with feathery crowns of foliage, through which the sun-beams trembled on the broad shining foliage of the tropical herbage below.

Silhet, though hot and damp, is remarkably healthy, and does not differ materially in temperature from Silchar, though it is more equable and humid.[2] It derives some interest from having been first brought into notice by the enterprise of one of the Lindsays of Balcarres, at a time when the pioneers of commerce in India encountered great hardships and much personal danger. Mr. Lindsay, a writer in the service of the East India Company, established a factory at Silhet, and commenced the lime trade

Himalaya, East Bengal, Malay Peninsula, and Indian islands; where perhaps more species grow than in any other part of the world. Such facts as this disturb our preconceived notions of the geographical distribution of the most familiar tribes of plants, and throw great doubt on the conclusions which fossil plants are supposed to indicate.

[1] *Gelonium*, *Adelia*, *Moacurra*, *Linostoma*, *Justicia*, *Trophis*, *Connarus*, *Ixora*, *Congea*, *Dalhousiea*, *Grewia*, *Myrsine*, *Büttneria*; and on the shady exposures a *Calamus*, *Briedelia*, and various ferns.

[2] During our stay of five days the mean maximum temperature was 74°, minimum 64° 8: that of thirty-two observations compared with Calcutta show that Silhet is only 1°·7 cooler, though Mr. Stainforth's house is upwards of 2° further north, and 150 feet more elevated. A thermometer sunk two feet seven inches, stood at 73° 5. The relative saturation-points were, Calcutta ·633, Silhet ·821.

with Calcutta,[1] reaping an enormous fortune himself, and laying the foundation of that prosperity amongst the people which has been much advanced by the exertions of the Inglis family, and has steadily progressed under the protecting rule of the Indian government.

From Silhet we took large boats to navigate the Burrampooter and Megna, to their embouchure in the Bay of Bengal at Noacolly, a distance of 250 miles, whence we were to proceed across the head of the bay to Chittagong, about 100 miles further. We left on the 7th of December, and arrived at Chattuc on the 9th, where we met our Khasia collectors with large loads of plants, and paid them off. The river was now low, and presented a busy scene, from the numerous trading boats being confined to its fewer and deeper channels. Long grasses and sedges (*Arundo*, *Saccharum* and *Scleria*), were cut, and stacked along the water's edge, in huge brown piles, for export and thatching.

On the 13th December, we entered the broad stream of the Megna. Rice is cultivated along the mud flats left by the annual floods, and the banks are lower and less defined than in the Soormah, and support no long grasses or bushes. Enormous islets of living water-grasses (*Oplismenus stagninus*) and other plants, floated past, and birds became more numerous, especially martins and egrets. The sun was hot, but the weather otherwise cool and pleasant: the mean temperature was nearly that of Calcutta, 69°·7, but the atmosphere was more humid.[2]

On the 14th we passed the Dacca river; below which the Megna is several miles wide, and there is an appearance of tide, from masses of purple *Salvinia* (a floating plant, allied to ferns), being thrown up on the beach like sea-weed. Still lower down, the vegetation of the Sunderbunds commences; there is a narrow beach, and behind it a mud bank several feet high, supporting a luxuriant green jungle of palms (*Borassus* and *Phœnix*), immense fig-trees, covered with *Calami*, and tall betel-palms, clothed with

[1] For an account of the early settlement of Silhet, see "Lives of the Lindsays," by Lord Lindsay.

[2] The river-water was greenish, and a little cooler (73°·8) than that of the Soormah (74°·3), which was brown and muddy. The barometer on the Soormah stood 0·028 inch higher than that of Calcutta (on the mean of thirty-eight observations), whereas on the Megna the pressure was 0·010 higher. As Calcutta is eighteen feet above the level of the Bay of Bengal, this shows that the Megna (which has no perceptible current) is at the level of the sea, and that either the Soormah is upwards of thirty feet above that level, or that the atmospheric pressure there, and at this season, is less than at Calcutta, which, as I have hinted at p. 476, is probably the case.

the most elegant drapery of *Acrostichum scandens*, a climbing fern with pendulous fronds.

Towards the embouchure, the banks rise ten feet high, the river expands into a muddy sea, and a long swell rolls in, to the disquiet of our fresh-water boatmen. Low islands of sand and mud stretch along the horizon: which, together with the ships, distorted by extraordinary refraction, flicker as if seen through smoke. Mud is the all-prevalent feature; and though the water is not salt, we do not observe in these broad deltas that amount of animal life (birds, fish, alligators, and porpoises) that teems in the narrow creeks of the western Sunderbunds.

We landed in a canal-like creek at Tuktacolly,[1] on the 17th, and walked to Noacolly, over a flat of hard mud or dried silt, covered with turf of *Cynodon Dactylon*. We were hospitably received by Dr. Baker, a gentleman who has resided here for twenty-three years; and who communicated to us much interesting information respecting the features of the Gangetic delta.

Noacolly is a station for collecting the revenue and preventing the manufacture of salt, which, with opium, are the only monopolies now in the hands of the East India Company. The salt itself is imported from Arracan, Ceylon, and even Europe, and is stored in great wooden buildings here and elsewhere. The ground being impregnated with salt, the illicit manufacture by evaporation is not easily checked; but whereas the average number of cases brought to justice used to be twenty and thirty in a week, they are now reduced to two or three. It is remarkable, that though the soil yields such an abundance of this mineral, the water of the Megna at Noacolly is only brackish, and it is therefore to repeated inundations and surface evaporation that the salt is due. Fresh water is found at a very few feet depth everywhere, but it is not good.

When it is considered how comparatively narrow the sea-board of the delta is, the amount of difference in the physical features of the several parts, will appear most extraordinary. I have stated that the difference between the northern and southern halves of the delta is so great, that, were all depressed and their contents fossilised, the geologist who examined each by itself, would hardly recognise the two parts as belonging to one epoch; and the difference between the east and west halves of the lower delta is equally remarkable.

The total breadth of the delta is 260 miles, from Chittagong to the mouth of the Hoogly, divided longitudinally by the Megna:

[1] "Colly" signifies a muddy creek, such as intersect the delta.

all to the west of that river presents a luxuriant vegetation, while to the east is a bare muddy expanse, with no trees or shrubs but what are planted. On the west coast the tides rise twelve or thirteen feet, on the east, from forty to eighty. On the west, the water is salt enough for mangroves to grow for fifty miles up the Hoogly; on the east, the sea coast is too fresh for that plant for ten miles south of Chittagong. On the west, fifty inches is the Cuttack fall of rain; on the east, 90 to 120 at Noacolly and Chittagong, and 200 at Arracan. The east coast is annually visited by earthquakes, which are rare on the west; and lastly, the majority of the great trees and shrubs carried down from the Cuttack and Orissa forests, and deposited on the west coast of the delta, are not only different in species, but in natural order, from those that the Fenny and Chittagong rivers bring down from the Eastern jungles.[1]

We were glad to find at Noacolly that our observations on the progression westwards of the Burrampooter (see p. 472) were confirmed by the fact that the Megna also is gradually moving in that direction, leaving much dry land on the Noacolly side, and islands opposite that coast; whilst it encroaches on the Sunderbunds, and is cutting away the islands in that direction. This advance of the fresh waters amongst the Sunderbunds is destructive to the vegetation of the latter, which requires salt; and if the Megna continues its slow course westwards, the obliteration of thousands of square miles of a very peculiar flora, and the extinction of many species of plants and animals that exist nowhere else, may ensue. In ordinary cases these plants, &c., would take up their abode on the east coast, as they were driven from the west; but such might not be the case in this delta; for the sweeping tides of the east coast prevent any such vegetation establishing itself there, and the mud which the eastern rivers carry down, becomes a caking dry soil, unsuited to the germination of seeds.

On our arrival at Calcutta in the following February, Dr. Falconer showed us specimens of very modern peat, dug out of the banks of the Hoogly a few feet below the surface of the soil, in which were seeds of the *Euryale ferox*:[2] this plant is not now

[1] The Cuttack forests are composed of teak, Sal, Sissoo, ebony, *Pentaptera*, *Buchanania*, and other trees of a dry soil, and that require a dry season alternating with a wet one. These are unknown in the Chittagong forests, which have Jarool (*Lagerstræmia*) *Mesua*, *Dipterocarpi*, nutmegs, oaks of several kinds, and many other trees not known in the Cuttack forests, and all typical of a perennially humid atmosphere.

[2] This peat Dr. Falconer also found to contain bones of birds and fish, seeds

known to be found nearer than Dacca (sixty miles north-east, see p. 473), and indicates a very different state of the surface at Calcutta at the date of its deposition than that which exists now, and also shows that the estuary was then much fresher.

The main land of Noacolly is gradually extending seawards, and has advanced four miles within twenty-three years: this seems sufficiently accounted for by the recession of the Megna. The elevation of the surface of the land is caused by the overwhelming tides and south-west hurricanes in May and October: these extend thirty miles north and south of Chittagong, and carry the waters of the Megna and Fenny back over the land, in a series of tremendous waves, that cover islands of many hundred acres, and roll three miles on to the main land. On these occasions, the average earthly deposit of silt, separated by micaceous sand, is an eight of an inch for every tide; but in October, 1848, these tides covered Sundeep island, deposited six inches on its level surface, and filled ditches several feet deep. These deposits become baked by a tropical sun, and resist to a considerable degree denudation by rain. Whether any further rise is caused by elevation from below is doubtful; there is no direct evidence of it, though slight earthquakes annually occur; and even when they have not been felt, the water of tanks has been seen to oscillate for three-quarters of an hour without intermission, from no discernible cause.[1]

Noacolly is considered a healthy spot, which is not the case with the Sunderbund stations west of the Megna. The climate is uniformly hot, but the thermometer never rises above 90,° nor sinks below 45°; at this temperature hoar-frost will form on straw, and ice on water placed in porous pans, indicating a powerful radiation.[2]

of *Cucumis Madraspatana* and other Cucurbitaceous plants, leaves of *Saccharum Sara* and *Ficus cordifolia*. Specks of some glistening substance were scattered through the mass, apparently incipient carbonisation of the peat.

[1] The natives are familiar with this phenomenon, of which Dr. Baker remembers two instances, one in the cold season of 1834–5, the other in that of 1830–1. The earthquakes do not affect any particular month, nor are they accompanied by any meteorological phenomena.

[2] The winds are north-west and north in the cold season (from November to March), drawing round to west in the afternoons. North-west winds and heavy hailstorms are frequent from March to May, when violent gales set in from the southward. The rains commence in June, with easterly and southerly winds, and the temperature from 82° to 84°; May and October are the hottest months. The rains cease in the end of October (on the 8th of November in 1849, and 12th of November in 1850, the latest epoch ever remembered): there is no land or sea breeze along any part of the coast. During our stay

We left Noacolly on the 19th for Chittagong; the state of the tide obliging us to go on board in the night. The distance is only 100 miles, but the passage is considered dangerous at this time (during the spring-tides) and we were therefore provided with a large vessel and an experienced crew. The great object in this navigation is to keep afloat and to make progress towards the top of the tide and during its flood, and to ground during the ebb in creeks where the bore (tidal wave) is not violent; for where the channels are broad and open, the height and force of this wave rolls the largest coasting craft over and swamps them.

Our boatmen pushed out at 3 in the morning, and brought up at 5, in a narrow muddy creek on the island of Sidhee. The waters retired along channels scooped several fathoms deep in black mud, leaving our vessel aground six or seven feet below the top of the bank, and soon afterwards there was no water to be seen; as far as the eye could reach, all was a glistening oozy mud, except the bleak level surfaces of the islands, on which neither shrub nor tree grew. Soon after 2 P.M. a white line was seen on the low black horizon, which was the tide-wave, advancing at the rate of five miles an hour, with a hollow roar; it bore back the mud that was gradually slipping along the gentle slope, and we were afloat an hour after: at night we grounded again, opposite the mouth of the Fenny.

By moonlight the scene was oppressively solemn: on all sides the gurgling waters kept up a peculiar sound that filled the air with sullen murmurs; the moonbeams slept upon the slimy surface of the mud, and made the dismal landscape more ghastly still. Silence followed the ebb, broken occasionally by the wild whistle of a bird like the curlew, of which a few wheeled through the air: till the harsh roar of the bore was heard, to which the sailors seemed to waken by instinct. The waters then closed in on every side, and the far end of the reflected moonbeam was broken into flashing light, that approached and soon danced beside the boat.

We much regretted not being able to abtain any more accurate data than I have given, as to the height of the tide at the mouth of the Fenny; but where the ebb sometimes retires twenty miles from high-water mark, it is obviously impossible to plant any tide-gauge.

On the 21st we were ashore at daylight on the Chittagong coast far north of the station, and were greeted by the sight of

we found the mean temperature for twelve observations to be precisely that of Calcutta, but the humidity was more, and the pressure 0·040 lower.

hills on the horizon: we were lying fully twenty feet below high-water mark, and the tide was out for several miles to the westward. The bank was covered with flocks of white geese feeding on short grass, upon what appeared to be detached islets on the surface of the mud. These islets, which are often an acre in extent, are composed of stratified mud; they have perpendicular sides several feet high, and convex surfaces, owing to the tide washing away the earth from under their sides; and they were further slipping seawards, along the gently sloping mud-beach. Few or no shells or seaweed were to be seen, nor is it possible to imagine a more lifeless sea than these muddy coasts present.

We were three days and nights on this short voyage, without losing sight of mud or land. I observed the barometer whenever the boat was on shore, and found the mean of six readings (all reduced to the same level) to be identical with that at Calcutta. These being all taken at elevations lower than that of the Calcutta observatory, show either a diminished atmospheric pressure, or that the mean level of high-water is not the same on the east and west coasts of the Bay of Bengal: this is quite possible, considering the widely different direction of the tides and currents on each, and that the waters may be banked up, as it were, in the narrow channels of the western Sunderbunds. The temperature of the air was the same as at Calcutta, but the atmosphere was damper. The water was always a degree warmer than the air.

We arrived at Chittagong on the 23rd of December, and became the guests of Mr. Sconce, Judge of the district, and of Mr. Lautour; to both of whom we were greatly indebted for their hospitality and generous assistance in every way.

Chittagong is a large town of Mahometans and Mugs, a Birmese tribe who inhabit many parts of the Malay peninsula, and the coast northward of it. The town stands on the north shore of an extensive delta, formed by rivers from the lofty mountains separating this district from Birma. These mountains are fine objects on the horizon, rising 4,000 to 8,000 feet; they are forest-clad, and inhabited by turbulent races, who are coterminous with the Cookies of the Cachar and Tipperah forests; if indeed they be not the same people. The mountains abound with the splendid timber-trees of the Cachar forests, but like these are said to want teak, Sal, and Sissoo; they have, besides many others, magnificent Gurjun trees (*Dipterocarpi*), the monarchs of the forests of these coasts.

The natives of Chittagong are excellent shipbuilders and active traders, and export much rice and timber to Madras and Calcutta.

The town is large and beautifully situated, interspersed with trees and tanks; the hills resemble those of Silhet, and are covered with a similar vegetation: on these the European houses are built. The climate is very healthy, which is not remarkable, considering how closely it approximates in character to that of Silhet, and other places in Eastern Bengal, but very extraordinary, if it be compared with Arracan, only 200 miles further south, which is extremely unhealthy. The prominent difference between the physical features of Chittagong and Arracan, is the presence of mangrove swamps at the latter place, for which the water is too fresh at the former.

The hills about the station are more than 150 or 200 feet high, and are formed of stratified gravel, sand, and clay, that often becomes nodular, and is interstratified with slag-like iron clay. Fossil wood is found; and some of the old buildings about Chittagong contain nummulitic limestone, probably imported from Silhet or the peninsula of India, with which countries there is no such trade now. The views are beautiful, of the blue mountains forty to fifty miles distant, and the many-armed river, covered with sails, winding amongst groves of cocoa-nuts, Areca palm, and yellow rice fields. Good European houses surmount all the eminences, surrounded by trees of *Acacia* and *Cæsalpinia*. In the hollows are native huts amidst vegetation of every hue, glossy green *Garciniæ* and figs, broad plantains, feathery *Cassia* and Acacias, dark *Mesua*, red-purple *Teminalia*, leafless scarlet-flowered *Bombax*, and grey *Casuarina*.[1] Seaward the tide leaves immense flats, call churs, which stretch for many miles on either side the offing.

We accompanied Mr. Sconce to a bungalow which he has built at the telegraph station at the south head of the harbour: its situation, on a hill 100 feet above the sea, is exposed, and at this season the sea-breeze was invigorating, and even cold, as it blew through the matting of the bungalow.[2] To the south, undulating dunes stretch along the coast, covered with low bushes, of which a red-flowered *Melastoma* is the most prevalent,[3] and is

[1] This, which is almost exclusively an Australian genus, is not indigenous at Chittagong: to it belongs an extra-Australian species common in the Malay islands, and found wild as far north as Arracan.

[2] The mean temperature of the two days (29th and 30th) we spent at this bungalow was 66°·5, that of Calcutta being 67°·6; the air was damp, and the barometer 0·144 lower at the flagstaff hill, but it fell and rose with the Calcutta instrument.

[3] *Melastoma*, jasmine, *Calamus*, *Ægle Marmelos*, *Adelia*, *Memecylon*, *Ixora*

considered a species of *Rhododendron* by many of the residents! The flats along the beach are several miles broad, intersected with tidal creeks, and covered with short grass, while below high-water mark all is mud, coated with green *Conferva*. There are no leafy seaweeds or mangroves, nor any seaside shrub but *Dilivaria ilicifolia*. Animal life is extremely rare; and a *Cardium*-like shell and small crab are found sparingly.

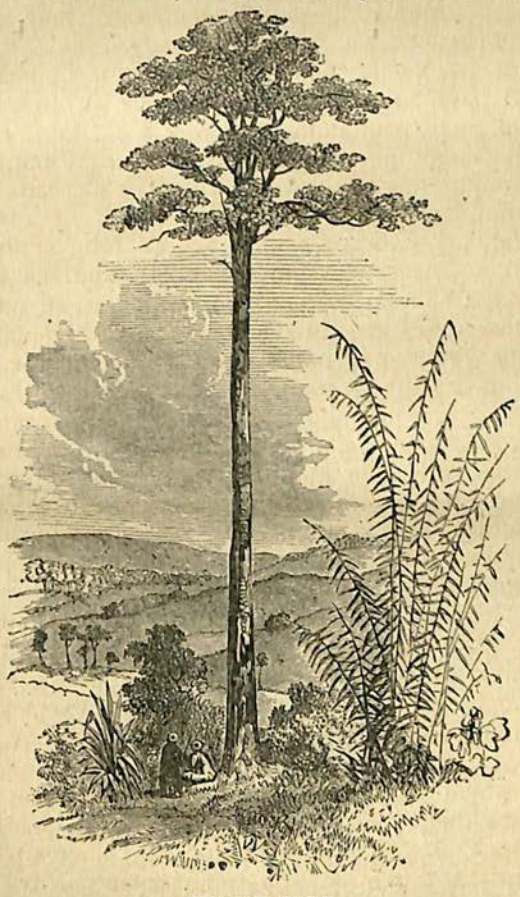
Coffee has been cultivated at Chittagong with great success; it is said to have been introduced by Sir W. Jones, and Mr. Sconce has a small plantation, from which his table is well supplied. Both Assam and Chinese teas flourish, but Chinamen are wanted to cure the leaves. Black pepper succeeds admirably, as do cinnamon, arrowroot, and ginger.

Early in January we accompanied Mr. Lautour on an excursion to the north, following a valley separated from the coast by a range of wooded hills, 1,000 feet high. For several marches the bottom of this valley was broad, flat, and full of villages. At Sidhee, about twenty-five miles from Chittagong, it contracts, and spurs from the hills on either flank project into the middle: they are 200 to 300 feet high, formed of red clay, and covered with brushwood. At Kajee-ke-hath, the most northern point we reached, we were quite amongst these hills, in an extremely picturesque country, intersected by long winding flat valleys, that join one another; some are full of copse-wood, while others present the most beautiful park-like scenery, and a third-class expand into grassy marshes or lake-beds, with wooded islets rising out of them. The hill-sides are clothed with low jungle, above which tower magnificent Gurjun trees (wood-oil). The whole contour of this country is that of a low bay, whose coast is raised above the sea, and over which a high tide once swept for ages.

The elevation of Hazari-ke-hath is not 100 feet above the level of the sea. It is about ten miles west of the mouth of the Fenny, from which it is separated by hills 1,000 feet high; its river falls into that at Chittagong, thirty miles south. Large myrtaceous trees (*Eugenia*) are common, and show a tendency to the Malayan flora, which is further demonstrated by the abundance of Gurjun (*Dipterocarpus turbinatus*). This is the most superb tree we met with in the Indian Forests: we saw several species, but this is the only common one here; it is conspicuous for its gigantic size, and for the straightness and graceful form of its tall unbranched pale grey trunk, and small symmetrical

Linostoma, *Congea*, climbing *Cæsalpinia*, and many other plants; and along their bases large trees of *Amoora*, *Gaurea*, figs, *Mesua*, and *Micromelon*.

crown. Many individuals were upwards of 200 feet high, and fifteen in girth. Its leaves are broad, glossy, and beautiful; the flowers (then falling) are not conspicuous; the wood is hard, close-grained, and durable, and a fragrant oil exudes from the trunk, which is extremely valuable as pitch and varnish, &c.,



GURJUN TREE.

besides being a good medicine. The natives procure it by cutting transverse holes in the trunk, pointing downwards, and lighting fires in them, which causes the oil to flow.[1]

[1] The other trees of these dry forests are many oaks, *Henslowia*, *Gordonia*, *Engelhardtia*, *Duabanga*, *Adelai*, *Byttneria*, *Bradleia*, and large trees of *Pongamia*, whose seeds yield a useful oil.

On the 8th of January we experienced a sharp earthquake, preceded by a dull thumping sound; it lasted about twenty seconds, and seemed to come up from the southward; the water of a tank by which we were seated was smartly agitated. The same shock was felt at Mymensing and at Dacca, 110 miles north-west of this.[1]

We crossed the dividing ridge of the littoral range on the 9th, and descended to Seetakoond bungalow, on the high road from Chittagong to Comilla. The forests at the foot of the range were very extensive, and swarmed with large red ants that proved very irritating: they build immense pendulous nests of dead and living leaves at the end of the branches of trees, and mat them with a white web. Tigers, leopards, wild dogs, and boars, are numerous; as are snipes, pheasants, peacocks, and jungle-fowl, the latter waking the morn with their shrill crows; and in strange association with them, the common English woodcock is occasionally found.

The trees are of little value, except the Gurjun, and "Kistooma," a species of *Bradleia*, which was stacked extensively, being used for building purposes. The papaw[2] is abundantly cultivated, and its great gourd-like fruit is eaten (called "Papita" or "Chinaman"); the flavour is that of a bad lemon, and a white juice exudes from the rind. The *Hodgsonia heteroclita* (*Trichosanthes* of Roxburgh), a magnificent Cucurbitaceous climber, grows in these forests; it is the same species as the Sikkim one (see p. 292). The long stem bleeds copiously when cut, and like almost all woody climbers, is full of large vessels; the juice does not, however, exude from these great tubes, which hold air, but from the close woody fibres. A climbing *Apocyneous* plant grows in these forests, the milk of which flows in a continuous stream, resembling caoutchouc (it is probably the *Urceola elastica*, which yields India-rubber).

The subject of plants bleeding is involved in obscurity, and the systematic examination of the motions in the juices of tropical climbers by resident observers, offers a fertile field to the naturalist. I have often remarked that if a climbing stem, in

[1] Earthquakes are extremely common, and sometimes violent, at Chittagong, and doubtless belong to the volcanic forces of the Malayan peninsula.

[2] The Papaw tree is said to have the curious property of rendering tough meat tender, when hung under its leaves, or touched with the juice; this hastening the process of decay. With this fact, well-known in the West Indies, I never found a person in the East acquainted.

which the circulation is vigorous, be cut across, it bleeds freely from both ends, and most copiously from the lower, if it be turned downwards; but that if a truncheon be severed, there may be no flow from either of its extremities. This is the case with all the Indian watery-juiced climbers, at whatever season they may be cut. When, however, the circulation in the plant is feeble, neither end of a simple cut will bleed much, but if a truncheon be taken from it, both the extremities will.

The ascent of the hills, which are densely wooded, was along spurs, and over knolls of clay; the rocks were sandy and slaty (dip north-east 60°). The road was good, but always through bamboo jungle, and it wound amongst the low spurs, so that there was no defined crest or top of the pass, which is about 800 feet high. There were no tall palms, tree-ferns, or plantains, no *Hymenophylla* or *Lycopodia*, and altogether the forest was smaller and poorer in plants than we had expected. The only palms (except a few rattans) were two kinds of *Wallichia*.

From the summit we obtained a very extensive and singular view. At our feet was a broad, low, grassy, alluvial plain, intersected by creeks, bounding a black expanse of mud which (the tide being out) appeared to stretch almost continuously to Sundeep Island, thirty miles distant; while beyond, the blue hills of Tipperah rose on the north-west horizon. The rocks yielded a dry poor soil, on which grew dwarf *Phœnix* and cycas-palm (*Cycas circinalis* or *pectinata*).

Descending, we rode several miles along an excellent road, that runs to Tipperah, and stopped at the bungalow of Seetakoond, twenty-five miles north of Chittagong. The west flank of the range which we had crossed is much steeper than the east, often precipitous, and presents the appearance of a sea-worn cliff towards the Bay of Bengal. Near Seetakoond (which is on the plain) a hill on the range, bearing the same name, rises 1,136 feet high, and being damper and more luxuriantly wooded, we were anxious to explore it, and therefore spent some days at the bungalow. Fields of poppy and sun (*Crotalaria juncea*) formed most beautiful crops; the latter grows from four to six feet high, and bears masses of laburnum-like flowers, while the poppy fields resembled a carpet of dark-green velvet, sprinkled with white stars; or, as I have elsewhere remarked, a green lake studded with water-lilies.

The road to the top of Seetakoond leads along a most beautiful valley, and then winds up a cliff that is in many places almost precipitous, the ascent being partly by steps cut in the rock, of

which there are 560. The mountain is very sacred, and there is a large Brahmin temple on its flank; and near the base a perpetual flame bursts out of the rock. This we were anxious to examine, and were extremely disappointed to find it a small vertical hole in a slaty rock, with a lateral one below for a draught, and that it is daily supplied by pious pilgrims and Brahmins with such enormous quantities of ghee (liquid butter), that it is to all intents and purposes an artificial lamp; no trace of natural phenomena being discoverable.

On the dry but wooded west face of the mountain, grows *Falconeria*, a curious Euphorbiaceous tree, with an acrid milky juice that affects the eyes when the wood is cut. Beautiful *Cycas* palms are also common, with *Terminalia*, *Bignonia*, *Sterculia*, dwarf *Phœnix* palm, and Gurjun trees. The east slope of the mountain is damper, and much more densely wooded; we there found two wild species of nutmeg trees, whose wood is full of a brown acrid oil, seven palms, tree-ferns, and many other kinds of ferns, several kinds of oak, *Dracæna*, and figs. The top is 1,136 feet above the sea, and commands an extensive view to all points of the compass; but the forests, in which the ashy bark of the Gurjun trees is conspicuous, and the beautiful valley on the west, are the only attractive features.

The weather on the east side of the range differs at this season remarkably from that on the west, where the vicinity of the sea keeps the atmosphere more humid and warm, and at the same time prevents the formation of the dense fogs that hang over the valleys to the eastward every morning at sunrise. We found the mean temperature at the bungalow, from January 9th till the 13th, to be 70° 2.

We embarked again at Chittagong on the 16th of January, at 10 P.M., for Calcutta, in a very large vessel, rowed by twelve men: we made wretchedly slow progress, for the reasons mentioned above (p. 535), being for four days within sight of Chittagong! On the 20th we only reached Sidhee, and thence made a stretch to Hattiah, an island which may be said to be moving bodily to the westward, the Megna annually cutting many acres from the east side, and the tide-wave depositing mud on the west. The surface is flat, and raised four feet above mean high-water level; the tide rises about 14 feet up the bank, and then retires for miles; the total rise and fall is, however, much less here than in the Fenny, higher up the gulf. The turf is composed of *Cynodon* and a *Fimbristylis*; and the earth being impregnated with salt, supports different kinds of *Chenopodium*. Two kinds of tamarisk,

and a thorny *Cassia* and *Excœcaria*, are the only shrubs on the eastern islands; on the central ones a few dwarf mangroves appear, with the holly-leaved *Dilivaria*, dwarf screw-pine (*Pandanus*), a shrub of *Compositæ*, and a curious fern, a variety of *Acrostichum aureum*. Towards the northern end of Hattiah, Talipot, cocoa-nut and date-palms appear.

On the 22nd we entered the Sunderbunds, rowing amongst narrow channels, where the tide rises but a few feet. The banks were covered with a luxuriant vegetation, chiefly of small trees, above which rose stately palms. On the 25th, we were overtaken by a steamer from Assam, a novel sight to us, and a very strange one in these creeks, which in some places seemed hardly broad enough for it to pass through. We jumped on board in haste, leaving our boat and luggage to follow us. She had left Dacca two days before, and this being the dry season, the route to Calcutta, which is but sixty miles in a straight line, involved a détour of three hundred.

From the masts of the steamer we obtained an excellent *coup-d'œil* of the Sunderbunds; its swamps clothed with verdure, and intersected by innumerable inosculating channels, with banks a foot or so high. The amount of tide, which never exceeds ten feet, diminishes in proceeding westwards into the heart of these swamps, and the epoch, direction, and duration of the ebb and flow vary so much in every canal, that at times, after stemming a powerful current, we found ourselves, without materially changing our course, suddenly swept along with a favouring stream. This is owing to the complex ramifications of the creeks, the flow of whose waters is materially influenced by the most trifling accidents of direction.

Receding from the Megna, the water became salter, and *Nipa fruticans* (see p. 1) appeared, throwing up pale yellow-green tufts of feathery leaves, from a short thick creeping stem, and bearing at the base of the leaves its great head of nuts, of which millions were floating on the waters, and vegetating in the mud. Marks of tigers are very frequent, and the footprints of deer, wild boars, and enormous crocodiles: these reptiles were extremely common, and glided down the mud banks on the approach of the steamer, leaving between the footmarks a deep groove in the mud made by their tail. The *Phœnix paludosa*, a dwarf slender-stemmed date-palm, from six to eight feet high, is the all-prevalent feature, covering the whole landscape with a carpet of feathery fronds of the liveliest green. The species is eminently gregarious, more so than any other Indian palm, and presents so dense a mass of

foliage, that when seen from above, the stems are wholly hidden.[1]

The water is very turbid, and only ten to twenty feet deep, which, we were assured by the captain, was not increased during the rains: it is loaded with vegetable matter, but the banks are always muddy, and we never saw any peat. Dense fogs prevented our progress in the morning, and we always anchored at dusk. We did not see a village or house in the heart of the Sunderbunds (though such do occur), but we saw canoes, with fishermen, who use the tame otter in fishing; and the banks were covered with piles of firewood, stacked for the Calcutta market. As we approached the Hoogly, the water became very salt and clear; the Nipa fruits were still most abundant, floating out to sea, but no more of the plant itself was seen. As the channels became broader, sand-flats appeared, with old salt factories, and clumps of planted *Casuarina*.

On the 28th of January we passed Saugor island, and entered the Hoogly, steamed past Diamond Harbour, and landed at the Botanic Garden Ghat, when we received a hearty welcome from Dr. Falconer. Ten days later we bade farewell to India, reaching England on the 25th of March, 1851

[1] *Sonneratia*, *Heritiera littoralis*, and *Careya*, form small gnarled trees on the banks, with deep shining green-leaved species of *Carallia*, *Rhizophora*, and other Mangroves. Occasionally the gigantic reed-mace (*Typha elephantina*) is seen, and tufts of tall reeds (*Arundo*).

APPENDIX.

PHYSICAL GEOGRAPHY OF THE SIKKIM HIMALAYA, EAST NEPAL, AND ADJACENT PROVINCES OF TIBET.

SIKKIM is included in a section of the Himalaya, about sixty miles broad from east to west, where it is bounded respectively by the mountain states of Bhotan and Nepal. Its southern limits are easily defined, for the mountains rise abruptly from the plains of Bengal, as spurs of 6,000 to 10,000 feet high, densely clothed with forest to their summits. The northern and north-eastern frontier of Sikkim is beyond the region of much rain, and is not a natural, but a political line, drawn between that country and Tibet. Sikkim lies nearly due north of Calcutta, and only four hundred miles from the Bay of Bengal; its latitude being 26° 40′ to 28° N., and longitude 88° to 89° E.

The main features of Sikkim are Kinchinjunga, the loftiest hitherto measured mountain, which lies to its north-west, and rises 28,178 feet above the level of the sea; and the Teesta river, which flows throughout the length of the country, and has a course of upwards of ninety miles in a straight line. Almost all the sources of the Teesta are included in Sikkim; and except some comparatively insignificant streams draining the outermost ranges, there are no rivers in this country but itself and its feeders, which occupy the largest of the Himalayan valleys between the Tambur in East Nepal, and the Machoo in Western Bhotan.

An immense spur, sixty miles long, stretches south from Kinchin to the plains of India; it is called Singalelah, and separates Sikkim from East Nepal; the waters from its west flank flow into the Tambur, and those from the east into the Great Rungeet, a feeder of the Teesta. Between these two latter rivers is a second spur from Kinchinjunga, terminating in Tendong.

The eastern boundary of Sikkim, separating it from Bhotan, is

formed for the greater part by the Chola range, which stretches south from the immense mountain of Donkia, 23,176 feet high, situated fifty miles E.N.E. of Kinchinjunga: where the frontier approaches the plains of India, the boundary line follows the course of the Teesta, and of the Rinkpo, one of its feeders, flowing from the Chola range. This range is much more lofty than that of Singalelah, and the drainage from its eastern flank is into the Machoo river, the upper part of whose course is in Tibet, and the lower in Bhotan.

The Donkia mountain, though 4,000 feet lower than Kinchin, is the culminant point of a much more extensive and elevated mountain mass. It throws off an immense spur from its north-west face, which runs west, and then south-west, to Kinchin, forming the watershed of all the remote sources of the Teesta. This spur has a mean elevation of 18,000 to 19,000 feet, and several of its peaks (of which Chomiomo is one) rise much higher. The northern boundary of Sikkim is not drawn along this, but runs due west from Donkia, following a shorter, but stupendous spur, called Kinchinjhow; whence it crosses the Teesta to Chomiomo, and is continued onwards to Kinchinjunga.

Though the great spur connecting Donkia with Kinchin is in Tibet, and bounds the waters that flow directly south into the Teesta, it is far from the true Himalayan axis, for the rivers that rise on its northern slope do not run into the valley of the Tsampu, or Tibetan Burrampooter, but into the Arun of Nepal, which rises to the north of Donkia, and flows south-west for many miles in Tibet, before entering Nepal and flowing south to the Ganges.

Sikkim, thus circumscribed, consists of a mass of mountainous spurs, forest-clad up to 12,000 feet; there are no flat valleys or plains in the whole country, no lakes or precipices of any consequence below that elevation, and few or no bare slopes, though the latter are uniformly steep. The aspect of Sikkim can only be understood by a reference to its climate and vegetation, and I shall therefore take these together, and endeavour, by connecting these phenomena, to give an intelligible view of the main features of the whole country.[1]

The greater part of the country between Sikkim and the sea is a dead level, occupied by the delta of the Ganges and Bur-

[1] This I did with reference especially to the cultivation of Rhododendrons, in a paper which the Horticultural Society of London did me the honour of printing. Quarterly Journ. of Hort. Soc., vol. vii. p. 82.

rampooter, above which the slope is so gradual to the base of the mountains, that the surface of the plain from which the Himalayas immediately rise is only 300 feet above the sea. The most obvious effect of this position is, that the prevailing southerly wind reaches the first range of hills, loaded with vapour. The same current, when deflected easterly to Bhotan, or westerly to Nepal and the north-west Himalaya, is intercepted and drained of much moisture, by the Khasia and Garrow mountains (south of Assam and by the Burrampooter) in the former case, and by the Rajmahal hills (south of the Ganges) in the latter. Sikkim is hence the dampest region of the whole Himalaya.

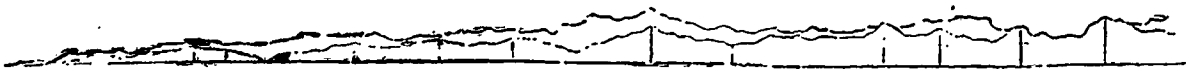
Viewed from a distance on the plains of India, Sikkim presents the appearance—common to all mountainous countries—of consecutive parallel ridges, running east and west: these are all wooded, and backed by a beautiful range of snowy peaks, with occasional breaks in the foremost ranges, through which the rivers debouch. Any view of the Himalaya, especially at a sufficient distance for the remote snowy peaks to be seen overtopping the outer ridges, is, however, rare, from the constant deposition of vapours over the forest-clad ranges during the greater part of the year, and the haziness of the dry atmosphere of the plains in the winter months. At the end of the rains, when the south-east monsoon has ceased to blow with constancy, views are obtained, sometimes from a distance of nearly two hundred miles. From the plains, the highest peaks subtend so small an angle, that they appear like white specks very low on the horizon, tipping the black lower and outer wooden ranges, which always rise out of a belt of haze, and from the density, probably, of the lower strata of atmosphere, are never seen to rest on the visible horizon. The remarkable lowness on the horizon of the whole stupendous mass is always a disappointing feature to the new comer, who expects to see dazzling peaks towering in the air. Approaching nearer, the snowy mountains sink behind the wooded ones, long before the latter have assumed gigantic proportions; and when they do so, they appear a sombre, lurid grey-green mass of vegetation, with no brightness or variation of colour. There is no break in this forest caused by rock, precipices, or cultivation; some spurs project nearer, and some valleys appear to retire further into the heart of the foremost great chain that shuts out all the country beyond.

From Darjeeling the appearance of parallel ridges is found to be deceptive, and due to the inosculating spurs of long tortuous ranges that run north and south throughout the whole length of

Sikkim, dividing deep wooded valleys, which form the beds of large rivers. The snowy peaks here look like a long east and west range of mountains, at an average distance of thirty or forty miles. Advancing into the country, this appearance proves equally deceptive, and the snowy range is resolved into isolated peaks, situated on the meridional ridges: their snow-clad spurs, projecting east and west, cross one another, and being uniformly white, appear to connect the peaks into one grand unbroken range. The rivers, instead of having their origin in the snowy mountains, rise far beyond them; many of their sources are upwards of one hundred miles in a straight line from the plains, in a very curious country, loftier by far in mean elevation than the meridional ridges which run south from it, yet comparatively bare of snow. This rearward part of the mountain region is Tibet, where all the Sikkim, Nepal, and Bhotan rivers rise as small streams, increasing in size as they receive the drainage from the snowed parts of the ridges that bound them in their courses. Their banks, between 8,000 and 14,000 feet, are generally clothed with rhododendrons, sometimes to the almost total exclusion of other wooded vegetation, especially near the snowy mountain—a cool temperature and great humidity being the most favourable conditions for the luxuriant growth of this genus.

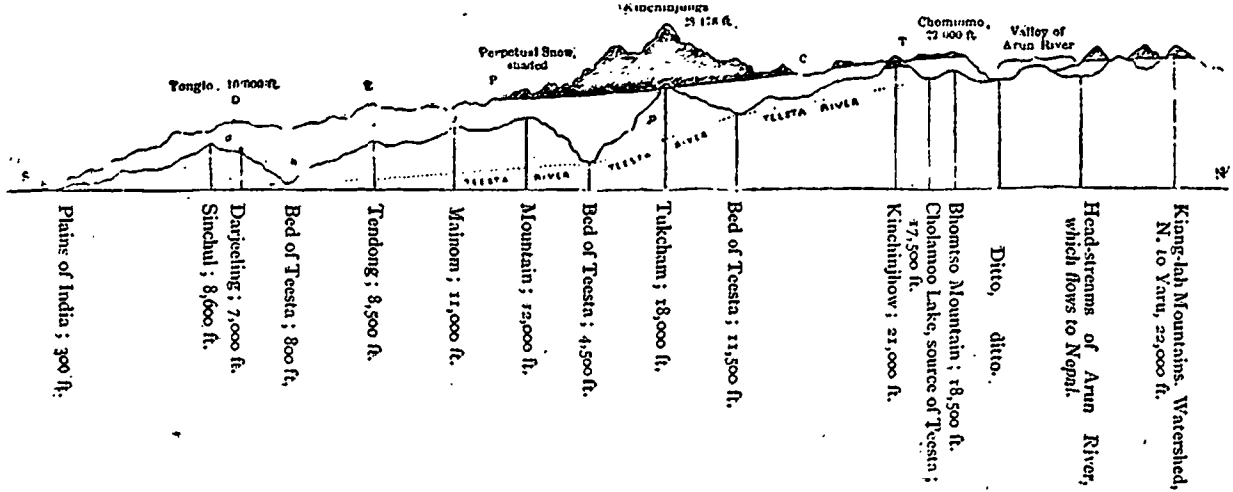
The source of this humidity is the southerly or sea wind which blows steadily from May to October in Sikkim, and prevails throughout the rest of the year, if not as the monsoon properly so called, as a current from the moist atmosphere above the Gangetic delta. This rushes north to the rarefied regions of Sikkim, up the great valleys, and does not appear materially disturbed by the north-west wind, which blows during the afternoon of the winter months over the plains, and along the flanks of the outer range, and is a dry surface current, due to the diurnal heating of the soil. When it is considered that this wind, after passing lofty mountains on the outer range, has to traverse eighty or one hundred miles of alps before it has watered all the forest region, it will be evident that its moisture must be expended before it reaches Tibet.

Let the figures in the accompanying woodcut, the one on the true scale, the other with the heights exaggerated, represent two of these long meridional ridges, from the watershed to the plains of India, following in this instance the course of the Teesta river, from its source at 19,000 feet to where it debouches from the Himalaya at 300. The lower rugged outline represents one meridional ridge, with all its most prominent peaks (whether



SOUTH. Section of the Sikkim Himalaya along the course of the Teesta River, from its source in Tibet to the Plains of India (about 120 miles).—True Scale. NORTH.

The same on a Scale in which the Heights are three times greater than on the True Scale.


Kinchinjunga
28 178 ft.
Perpetual Snow, shaded
Tongio, 19 000 ft.
Chomiomo, 22 000 ft.
Valley of Arun River
TEESTA RIVER
Plains of India; 300 ft.
Sinchul; 8,600 ft.
Darjeeling; 7,000 ft.
Bed of Teesta; 800 ft.
Tendong; 8,500 ft.
Malinom; 11,000 ft.
Mountain; 12,000 ft.
Bed of Teesta; 4,500 ft.
Tukcham; 18,000 ft.
Bed of Teesta; 11,500 ft.
Kinchinjhow; 21,000 ft.
Cholamoo Lake, source of Teesta; 17,500 ft.
Bhomtso Mountain; 18,500 ft.
Ditto, ditto.
Head-streams of Arun River, which flows to Nepal.
Kiang-lah Mountains. Watershed, N. to Yaru, 22,000 ft.

exactly or not on the line of section); the upper represents the parallel ridge of Singalelah (D.E.P.), of greater mean elevation, further west, introduced to show the maximum elevation of the Sikkim mountains, Kinchinjunga (28,178 feet), being represented on it. A deep valley is interposed between these two ridges, with a feeder of the Teesta in it (the Great Rungeet), which runs south from Kinchin, and turning west enters the Teesta at R. The position of the bed of the Teesta river is indicated by a dotted line from its source at T to the plains at S; of Darjeeling, on the north flank of the outer range, by *d*; of the first point where perpetual snow is met with, by P; and of the first indications of a Tibetan climate by C.

A warm current of air, loaded with vapour, will deposit the bulk of its moisture on the ridge of Sinchul, which rises above Darjeeling (*d*), and is 8,500 feet high. Passing on, little will be precipitated on *e*, whose elevation is the same as that of Sinchul; but much at *f* (11,000 feet), where the current, being further cooled, has less capacity for holding vapour, and is further exhausted. When it ascends to P (15,000 feet) it is sufficiently cooled to deposit snow in the winter and spring months, more of which falling than can be melted during the summer, it becomes perennial. At the top of Kinchin very little falls, and it is doubtful if the southerly current ever reaches that prodigiously elevated isolated summit. The amount of surface above 20,000 feet is, however, too limited and broken into isolated peaks to drain the already nearly exhausted current, whose condensed vapours roll along in fog beyond the parallel of Kinchin, are dissipated during the day over the arid mountains of Tibet, and deposited at night on the cooled surface of the earth.

Other phenomena of no less importance than the distribution of vapour, and more or less depending on it, are the duration and amount of solar and terrestrial radiation. Towards D the sun is rarely seen during the rainy season, as well from the constant presence of nimbi aloft, as from fog on the surface of the ground. An absence of both light and heat is the result south of the parallel of Kinchin; and at C low fogs prevail at the same season; but do not intercept either the same amount of light or heat; whilst at T there is much sunshine and bright light. During the night, again, there is no terrestrial radiation between S and P; the rain either continues to pour—in some months with increased violence—or the saturated atmosphere is condensed into a thick white mist, which hangs over the redundant vegetation. A bright starlight night is almost unknown in the

summer months at 6,000 to 10,000 feet, but is frequent in December and January, and at intervals between October and May, when, however, vegetation is little affected by the cold of nocturnal radiation. In the regions north of Kinchin, starlight nights are more frequent, and the cold produced by radiation, at 14,000 feet, is often severe towards the end of the rains in September. Still the amount of clear weather during the night is small; the fog clears off for an hour or two at sunset as the wind falls, but the returning cold north current again chills the air soon afterwards, and rolling masses of vapour are hence flying overhead, or sweeping the surface of the earth, throughout the summer nights. In the Tibetan regions, on the other hand, bright nights and even sharp frosts prevail throughout the warmest months.

Referring again to the cut, it must be borne in mind that neither of the two meridional ridges runs in a straight line, but that they wind or zigzag as all mountain ranges do; that spurs from each ridge are given off from either flank alternately, and that the origin of a spur on one side answers to the source of a river (*i.e.*, the head of a valley) on the other. These rivers are feeders of the main stream, the Teesta, and run at more or less of an angle to the latter. The spurs from the east flank of one ridge cross, at their ends, those from the west flank of another; and thus transverse valleys are formed, presenting many modifications of climate with regard to exposure, temperature, and humidity.

The routes from the plains of India to the watershed in Tibet always cross these lateral spurs. The main ridge is too winding and rugged, and too lofty for habitation throughout the greater part of its length, while the river-channel is always very winding, unhealthy for the greater part of the year below 4,000 feet, and often narrow, gorge-like, and rocky. The villages are always placed above the unhealthy regions, on the lateral spurs, which the traveller repeatedly crosses throughout every day's march; for these spurs give off lesser ones, and these again others of a third degree, whence the country is cut up into as many spurs, ridges, and ranges, as there are rills, streams, and rivers amongst the mountains.

Though the direction of the main atmospheric current is to the north, it is in reality seldom felt to be so, except the observer be on the very exposed mountain tops, or watch the motions of the upper strata of atmosphere. Lower currents of air rush up both the main and lateral valleys, throughout the day; and from the

sinuosities in the beds of the rivers, and the generally transverse directions of their feeders, the current often becomes an east or west one. In the branch valleys draining to the north the wind still ascends; it is, in short, an ascending warm, moist current, whatever course be pursued by the valleys it follows.

The sides of each valley are hence equally supplied with moisture, though local circumstances render the soil on one or the other flank more or less humid and favourable to a luxuriant vegetation: such differences are a drier soil on the north side, with a too free exposure to the sun at low elevations, where its rays, however transient, rapidly dry the ground, and where the rains, though very heavy, are of shorter duration, and where, owing to the capacity of the heated air for retaining moisture, day fogs are comparatively rare. In the northern parts of Sikkim, again, some of the lateral valleys are so placed that the moist wind strikes the side facing the south, and keeps it very humid, whilst the returning cold current from the neighbouring Tibetan mountains impinges against the side facing the north, which is hence more bare of vegetation. An infinite number of local peculiarities will suggest themselves to any one conversant with physical geography, as causing unequal local distribution of light, heat, and moisture in the different valleys of so irregular a country; namely, the amount of slope, and its power of retaining moisture and soil; the composition and hardness of the rocks; their dip and strike; the protection of some valleys by lofty snowed ridges; and the free southern exposures of others at great elevations.

The position and elevation of the perpetual snow[1] vary with

[1] It appears to me, as I have asserted in the pages of my Journal, that the limit of perpetual snow is laid down too low in all mountain regions, and that accumulations in hollows, and the descent of glacial ice, mask the phenomenon more effectually than is generally allowed. In this work I define the limit, as is customary, in general terms only, as being that where the accumulations are very great, and whence they are continuous upwards, on gentle slopes. All perpetual snow, however, becomes ice, and, as such, obeys the laws of glacial motion, moving as a viscous fluid; whence it follows that the lower edge of a snow-bed placed on a slope is, in one sense, the termination of a glacier, and indicates a position below that where all the snow that falls melts. I am well aware that it is impossible to define the limit required with any approach to accuracy. Steep and broken surfaces, with favourable exposures to the sun or moist winds, are bare much above places were snow lies through out the year; but the occurrence of a gentle slope, free of snow, and covered with plants, cannot but indicate a point below that of perpetual snow. Such is the case with the "Jardin" on the Mer de Glace, whose elevation is 9,500 feet, whereas that of perpetual snow is considered by Professor J. Forbes, our best authority, to be 8,500 feet. Though limited in area, girdled by glaciers,

those of the individual ranges, and their exposure to the south wind. The expression that the perpetual snow lies lower and deeper on the southern slopes of the Himalayan mountains than on the northern, conveys a false impression. It is better to say that the snow lies deeper and lower on the southern faces of the individual mountains and spurs that form the snowy Himalaya. The axis itself of the chain is generally far north of the position of the spurs that catch all the snow, and has comparatively very little snow on it, most of what there is lying upon north exposures.

A reference to the woodcut will show that the same circumstances which affect the distribution of moisture and vegetation, determine the position, amount, and duration of the snow. The principal fall will occur, as before shown, where the meridional range first attains a sufficiently great elevation, and the air becomes consequently cooled below 32°; this is at a little above 14,000 feet, sporadic falls occurring even in summer at that elevation: these, however, melt immediately, and the copious winter falls also are dissipated before June. As the depth of rain-fall diminishes in advancing north to the higher parts of the meridional ranges, so does that of the snow-fall. The permanence of the snow, again, depends on—1. The depth of the accumulation; 2. The mean temperature of the spot; 3. The melting power of the sun's rays; 4. The prevalence and strength of evaporating winds. Now at 14,000 feet, though the accumulation is immense, the amount melted by the sun's rays is trifling, and there are no evaporating winds; but the mean temperature is so high, and the corroding powers of the rain (which falls abundantly throughout summer) and of the warm and humid ascending currents are so great, that the snow is not perennial. At 15,500 feet, again, it

presenting a very gentle slope to the east, and screened by surrounding mountains from a considerable portion of the sun's rays, the Jardin is clear, for fully three months of the year, of all but sporadic falls of snow, that never lie long; and so are similar spots placed higher on the neighbouring slopes; which facts are quite at variance with the supposition that the perpetual snow-line is below that point in the Mont Blanc Alps. On the Monte Rosa Alps, again, Dr. Thomson and I gathered plants in flower, above 12,000 feet, on the steep face of the Weiss-thor Pass, and at 10,938 feet on the top of St. Théodule; but in the former case the rocks are too steep for any snow to lie, they are exposed to the south-east, and overhang a gorge 8,000 feet deep, up which no doubt warm currents ascend; while at St. Théodule the plants were growing on a slope which, though gentle, is black and stony, and exposed to warm ascending currents, as on the Weiss-thor; and I do not consider either of these as evidences of the limit of perpetual snow being higher than their position.

becomes perennial, and its permanence at this low elevation (at P) is much favoured by the accumulation and detention of fogs over the rank vegetation which prevails from S nearly to P; and by the lofty mountains beyond it, which shield it from the returning dry currents from the north. In proceeding north all the circumstances that tend to the dispersion of the snow increase, whilst the fall diminishes. At P the deposition is enormous and the snow-line low—16,000 feet; whilst at T little falls, and the limit of perpetual snow is 19,000 and 20,000 feet. Hence the anomaly, that the snow-line ascends in advancing north to the coldest Himalayan regions. The position of the greatest peaks and of the greatest mass of perpetual snow being generally assumed as indicating a ridge and watershed, travellers, arguing from single mountains alone, on the meridional ridges, have at one time supported and at another denied the assertion, that the snow lies longer and deeper on the north than on the south slope of the Himalayan ridge.

The great accumulation of snow at 15,000 feet, in the parallel of P, exercises a decided influence on the vegetation. The alpine rhododendrons hardly reach 14,000 feet in the broad valleys and round-headed spurs of the mountains of the Tunkra and Chola passes; whilst the same species ascend to 16,000, and one to 17,000 feet, at T. Beyond the latter point, again, the great aridity of the climate prevents their growth, and in Tibet there are generally none even as low as 12,000 and 14,000 feet. Glaciers, again, descend to 15,000 feet in the tortuous gorges which immediately debouch from the snows of Kinchinjunga, but no plants grow on the débris they carry down, nor is there any sward of grass or herbage at their base, the atmosphere immediately around being chilled by enormous accumulations of snow, and the summer sun rarely warming the soil. At T, again, the glaciers do not descend below 16,000 feet, but a greensward of vegetation creeps up to their bases, dwarf rhododendrons cover the moraines, and herbs grow on the patches of earth carried down by the latter, which are thawed by the more frequent sunshine, and by the radiation of heat from the unsnowed flanks of the valleys down which these ice-streams pour.

Looking eastward or westward on the map of India, we perceive that the phenomenon of perpetual snow is regulated by the same laws. From the longitude of Upper Assam in 95° E to that of Kashmir in 75° E, the lowest limit of perpetual snow is 15,000 to 16,000 feet, and a shrubby vegetation affects the most humid localities near it, at 12,000 to 14,000 feet. Receding from the

plains of India and penetrating the mountains, the climate becomes drier, the snow-line rises, and vegetation diminishes, whether the elevation of the land increases or decreases; plants reaching 17,000 and 18,000 feet, and the snow-line, 20,000 feet. To mention extreme cases; the snow-level of Sikkim in 27° 30 is at 16,000 feet, whereas in latitude 35° 30 Dr. Thomson found the snow-line 20,000 feet on the mountains near the Karâkoram Pass, and vegetation up to 18,500 feet—features I found to be common also to Sikkim in latitude 28°.

The Himalaya, north of Nepal, and thence eastward to the bend of the Yaru-Tsampu (or Tibetan Burrampooter) has for its geographical limits the plains of India to the south, and the bed of the Yaru to the north. All between these limits is a mountain mass, to which Tibet (though so often erroneously called a plain)[1] forms no exception. The waters from the north side of this chain flow into the Tsampu, and those from the south side into the Burrampooter of Assam, and the Ganges. The line, however tortuous, dividing the heads of these waters, is the watershed, and the only guide we have to the axis of the Himalaya. This has never been crossed by Europeans, except by Captain Turner's embassy in 1798, and Captain Bogle's in 1779, both of which reached the Yaru river. In the account published by Captain Turner, the summit of the watershed is not rigorously defined, and the boundary of Tibet and Bhotan is sometimes erroneously taken for it; the boundary being at that point a southern spur of Chumulari.[2] Eastwards from the sources of the Tsampu, the watershed of the Himalaya seems to follow a very winding course, and to be everywhere to the north of the snowy peaks seen from the plains of India. It is by a line through these snowy peaks that the axis of the Himalaya is represented in all our maps; because they *seem* from the plains to be situated on an east and

[1] The only true account of the general features of eastern Tibet is to be found in MM. Huc and Gabet's travels. Their description agrees with Dr. Thomson's account of western Tibet, and with my experience of the parts to the North of Sikkim, and the information I everywhere obtained. The so-called *plains* are the flat floors of the valleys, and the terraces on the margins of the rivers, which all flow between stupendous mountains. The term "maidan," so often applied to Tibet by the natives, implies, not a plain like that of India, but simply an open, dry, treeless country, in contrast to the densely wooded wet regions of the snowy Himalaya, south of Tibet.

[2] Between Donkia and Chumulari lies Choombi, a portion of Tibet (including the upper part of the course of the Machoo river) bounded on the east by Bhotan, and on the west by Sikkim (see p. 366). Turner, when crossing the Simonang Pass, descended westwards into the valley of the Machoo, and was still on the Indian watershed,

west ridge, instead of being placed on subsidiary meridional ridges, as explained above. It is also across or along the subsidiary ridges that the boundary line between the Tibetan provinces and those of Nepal, Sikkim, and Bhotan, is usually drawn; because the enormous accumulations of snow form a more efficient natural barrier than the greater height of the less snowed central part of the chain beyond them.

Though, however, our maps draw the axis through the snowy peaks, they also make the rivers to rise beyond the latter, on the northern slopes as it were, and to flow southwards through gaps in the axis. Such a feature is only reconcilable with the hypothesis of the chain being double, as the Cordillera of Peru and Chili is said to be, geographically, and which in a geological sense it no doubt is: but to the Cordillera the Himalaya offers no parallel. The results of Dr. Thomson's study of the north-west Himalaya and Tibet, and my own of the north-east extreme of Sikkim and Tibet, first gave me an insight into the true structure of this chain. Donkia mountain is the culminant point of an immensely elevated mass of mountains, of greater mean height than a similarly extensive area around Kinchinjunga. It comprises Chumulari, and many other mountains much above 20,000 feet, though none equal Kinchinjunga, Junnoo, and Kubra. The great lakes of Ramchoo and Cholamoo are placed on it, and the rivers rising on it flow in various directions; Painomchoo north-west into the Yaru; the Arun west to Nepal; the Teesta south-west through Sikkim; the Machoo south, and the Pachoo south-east, through Bhotan. All these rivers have their sources far beyond the great snowed mountains, the Arun most conspicuously of all, flowing completely at the back or north of Kinchinjunga. Those that flow southwards, break through no chain, nor do they meet any contraction as they pass the snowy parts of the mountains which bound the valleys in which they flow, but are bound by uniform ranges of lofty mountains, which become more snowy as they approach the plains of India. The valleys, however, gradually contract as they descend, being less open in Sikkim and Nepal than in Tibet, though there bounded by rugged mountains, which from being so bare of snow and of vegetation, do not give the same impression of height as the isolated sharper peaks which rise out of a dense forest, and on which the snow limit is 4,000 or 5,000 feet lower.

The fact of the bottom of the river valleys being flatter towards the watershed, is connected with that of their fall being less rapid at that part of their course; this is the consequence of the great

extent in breadth of the most elevated position of the chain. If we select the Teesta as an example, and measure its fall at three points of its course, we shall find the results very different. From its principal source at Lake Cholamoo, it descends from 17,000 to 15,000 feet, with a fall of 60 feet to the mile; from 15,000 to 12,000 feet, the fall is 140 feet to the mile; in the third part of its course it descends from 12,000 to 5,000 feet, with a fall of 160 feet to the mile; and in the lower part the descent is from 5,000 feet to the plains of India at 300 feet, giving a fall of 50 feet to the mile. There is, however, no marked limit to these divisions; its valley gradually contracts, and its course gradually becomes more rapid. It is worthy of notice that the fall is at its maximum through that part of the valley of which the flanks are the most loaded with snow; where the old moraines are very conspicuous, and where the present accumulations from landslips, &c., are the most extensive.[1]

With reference to Kinchinjunga these facts are of importance, as showing that mere elevation is in physical geography of secondary importance. That lofty mountain rises from a spur of the great range of Donkia, and is quite removed from the watershed or axis of the Himalaya, the rivers which drain its northern and southern flanks alike flowing to the Ganges. Were the Himalaya to be depressed 18,000 feet, Kubra, Junnoo, Pundim, &c., would form a small cluster of rocky islands 1,000 to 7,000 feet high, grouped near Kinchinjunga, itself a cape of 10,000 feet high, which would be connected by a low, narrow neck, with an extensive and mountainous tract of land to its north-east; the latter being represented by Donkia. To the north of Kinchin a deep bay or inlet would occupy the present valley of the Arun, and would be bounded on the north by the axis of the Himalaya, which forms a continuous tract of land beyond it. Since writing the above, I have seen Professor J. Forbes's beautiful work on the glaciers of Norway: it fully justifies a comparison of the Himalaya to Norway, which has long been a familiar subject of theoretical enquiry with Dr. Thomson and myself. The deep narrow valleys of Sikkim admirably represent the Norwegian fiords; the lofty, rugged, snowy mountains, those more or less submerged islands of the Norwegian

[1] It is not my intention to discuss here the geological bearings of this curious question; but I may state that as the humidity of the climate of the middle region of the river-course tends to increase the fall in a given space, so I believe the dryness of the climate of the loftier country has the opposite effect, by preserving those accumulations which have raised the floors of the valleys and rendered them level.

coast; the broad rearward watershed, or axis of the chain, with its lakes, is the same in both, and the Yaru-tsampu occupies the relative position of the Baltic.

Along the whole chain of the Himalaya east of Kumaon there are, I have no doubt, a succession of such lofty masses as Donkia, giving off stupendous spurs such as that on which the Kinchin forms so conspicuous a feature. In support of this view we find every river rising far beyond the snowy peaks, which are separated by continuously unsnowed ranges placed between the great white masses that these spurs present to the observer from the south.[1] From the Khasia mountains (south-east of Sikkim) many of these groups or spurs were seen by Dr. Thomson and myself, at various distances (80 to 210 miles); and these groups were between the courses of the great rivers the Soobansiri, Monass, and Pachoo, all east of Sikkim. Other masses seen from the Gangetic valley probably thus mark the relative positions of the Arun, Cosi, Gunduk, and Gogra rivers.

Another mass like that of Chumulari and Donkia, is that around the Mansarowar lakes, so ably surveyed by the brothers Captains R. and H. Strachey, which is evidently the centre of the Himalaya. From it the Gogra, Sutlej, Indus, and Yaru rivers all flow to the Indian side of Asia; and from it spring four chains, two of which are better known than the others. These are:—1. The eastern Himalaya, whose axis runs north of Nepal, Sikkim, and Bhotan, to the bend of the Yaru, the valley of which it divides from the plains of India. 2. The north-west Himalaya, which separates the valley of the Indus from the plains of India. Behind these, and probably parallel to them, lie two other chains. 3. The Kouenlun or Karakoram chain, dividing the Indus from the Yarkand river. 4. The chain north of the Yaru, of which nothing is known. All the waters from the two first of these chains flow into the Indian Ocean, as do those from the south faces of the third and fourth; those from the north side of the Kouenlun, and of the chain north of the Yaru, flow into the great valley of Lake Lhop, which may once have been continuous with the Amoor river.[2]

For this view of the physical geography of the western Hima-

[1] At p. 129 I have particularly called attention to the fact, that west of Kinchinjunga there is no continuation of a snowy Himalaya, as it is commonly called. So between Donkia and Chumulari there is no perpetual snow, and the valley of the Machoo is very broad, open, and comparatively flat.

[2] The Chinese assert that Lake Lhop once drained into the Hoang-ho; the statement is curious, and capable of confirmation when central Asia shall have been explored.

laya and central Asia, I am indebted to Dr. Thomson. It is more consonant with nature, and with what we know of the geography of the country and of the nature of mountain chains, than that of the illustrious Humboldt, who divides central Asia by four parallel chains, united by two meridional ones; one at each extremity of the mountain district. It follows in continuation and conclusion of our view that the mountain mass of Pamir or Bolor, between the sources of the Oxus and those of the Yarkand river, may be regarded as a centre from which spring the three greatest mountain systems of Asia. These are:—1. A great chain, which runs in a north-easterly direction as far as Behring's Straits, separating all the rivers of Siberia from those which flow into the Pacific Ocean. 2. The Hindoo Koosh, continued through Persia and Armenia into Taurus. And, 3. The Muztagh or Karakorum, which probably extends due east into China, south of the Hoang-ho, but which is broken up north of Mansarowar into the chains which have been already enumerated.

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